REPORT 9

SWEEP

SOIL AND WATER

ENVIRONMENTAL

ENHANCEMENT PROGRAM

PAMPA

PROGRAMME D'AMÉLIORATION

DU MILIEU PÉDOLOGIQUE

ET AQUATIQUE

Canada

Ontario

SWEEP

is a $30 million federal-provincial agreement, announced May 8, 1986, designed to improve soil and water quality in southwestern Ontario over the next five years.

PURPOSES

There are two interrelated purposes to the program; first, to reduce phosphorus loadings in the Lake Erie basin from cropland run-off; and second, to improve the productivity of southwestern Ontario agriculture by reducing or arresting soil erosion that contributes to water pollution.

BACKGROUND

The Canada-U.S. Great Lakes Water Quality Agreement called for phosphorus reductions in the Lake Erie basin of 2000 tonnes per year. SWEEP is part of the Canadian agreement, calling for reductions of 300 tonnes per year — 200 from croplands and 100 from industrial and municipal sources.

PAMPA

est une entente fédérale-provinciale de 30 millions de dollars, annoncée le 8 mai 1986, et destinée à améliorer la qualité du sol et de l'eau dans le Sud-ouest de l'Ontario.

SES BUTS

Les deux buts de PAMPA sont: en premier lieu de réduire de 200 tonnes par an d'ici 1990 le déversement dans le lac Erie de phosphore provenant des terres agricoles, et de maintenir ou d'accroître la productivité agricole du Sud-ouest de l'Ontario, en réduisant ou en empêchant l'érosion et la dégradation du sol.

SES GRANDES LIGNES

L'entente entre le Canada et les États-Unis sur la qualité de l'eau des Grands Lacs prévoyait de réduire de 2 000 tonnes par an la pollution due au phosphore dans le bassin du lac Erie. PAMPA fait partie de cette entente qui réduira cette pollution de 300 tonnes par an — 200 tonnes provenant des terres agricoles et 100 tonnes provenant de sources industrielles et municipales.

100-05203/

CONSERVATION PRACTICES IN SOUTHWESTERN ONTARIO AGRICULTURE: BARRIERS TO ADOPTION

A REPORT TO

AGRICULTURE CANADA

THE SOIL AND WATER ENVIRONMENTAL ENHANCEMENT PROGRAM

SOCIO-ECONOMIC ANALYSIS PROJECT

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However, the views and opinions contained herein are those of the authors and do not necessarily reflect the views of Agriculture Canada or the SWEEP Management Committee.

PREFACE AND ACKNOWLEDGEMENTS

This report, examining barriers to the adoption of conservation practices by Southwestern Ontario farmers, was completed for the socio-economic analysis component of the Soil and Water Environmental Enhancement Program (SWEEP). The authors gratefully acknowledge the support of SWEEP, and particularly that of the Agriculture Development Branch, Agriculture Canada.

We also wish to express our appreciation to several individuals for their contributions to, and support of, this research initiative. Special thanks to Mr. R. Seguin, Scientific Authority, Agriculture Canada; Mr. B. Fraser, Kent County Agricultural Representative, Ontario Ministry of Agriculture and Food; Mr. C. Manley, Oxford County Department of Planning and Development; and to the numerous academic and professional researchers who contributed suggestions and criticisms during the design of the research methodology and survey instrument. Thanks are also due to Ms. D. Bond, Land Evaluation Group, University of Guelph, for editorial and administrative assistance.

Finally, the authors wish to extend sincere thanks to the farmers of Kent and Oxford Counties, who provided necessary and valued information throughout the duration of the study.

EXECUTIVE SUMMARY

1 Purpose and Overview

Concern over the degradation of soil and water resources has prompted the development of numerous technological advancements in agriculture. These technologies, combined with the resurrection of some traditional farming methods, provide the means for using agricultural lands in ways that minimize environmental degradation. Despite these positive developments, technological advancements are of little value until they are applied. Consequently, there now exists considerable interest in identifying and evaluating the factors that influence technology transfer.

Soil conservation research in Ontario and other jurisdictions suggests that many farmers are aware of the existence of soil conservation technologies, and are favourably disposed toward land stewardship. Despite these facts, the adoption of conservation technologies and practices has not been widespread. It is now evident that positive attitudes and awareness are necessary, but not sufficient, to ensure adoption. The conclusion is that other forces are constraining many farmers from acting on their pro-conservation attitudes.

The purpose of this research is to identify barriers to conservation in agricultural land use, and to assess the prospects for their removal. The major objectives of the study are:

1. to identify the nature and extent of conservation practices by farmers in Southwestern Ontario,
2. to identify, characterize and evaluate the major barriers to the use of conservation practices, and

3. to consider factors which promote and/or obstruct adoption of soil conservation practices for policies and programs.

2 Strategy and Methods

The completion of this study involved a review of scholarly and professional literature, the collection of primary data pertaining to farms and farmers through the administration of a mail questionnaire and through telephone interviews, and the use of secondary data sources as appropriate. Primary data for the study were collected between August and November 1988.

The selection of the study area was guided by the geographical focus of the Soil and Water Environmental Enhancement Program, and the desire to include a range of biophysical conditions and farm business types. In view of these requirements, the counties of Kent and Oxford were selected for examination.

Prior to undertaking the analysis, it was necessary to devise a measurement technique for assessing conservation practice use among farms. A classification scheme was developed which reflected the intensity or level of conservation effort based on the number and type of practices used. The classification scheme was used to identify physical, personal and farm business factors related to higher levels of adoption. While considerable variation existed between adopter groups, over 90 per cent of respondents claimed to use at least some conservation practice on the land they farmed.

3 Summary of Results

A range of variables relating to the human, physical, and economic characteristics of the farm operation were tested for their possible association with the use of conservation practices. Significant influences on adoption were: scale of farm operations, perceptions of erosion and other soil problems,

age of the farm operator, membership in farm organizations, concern over the seriousness of erosion as an agricultural issue, and tenure. Several possible barriers to conservation practice use were inferred from the findings. They include lack of land, lack of investment capital, age (at either extreme), and may include failure to recognize soil problems, lack of knowledge regarding possible solutions, and lack of conservation concern.

The issue of reported or perceived barriers to adoption, and the prospects for their removal was addressed. While a broad range of barriers to adoption was identified, the most commonly cited were perceived inadequacy of the technologies, perceived lack of need for practices, financial constraints relating to investment capital and foregone income, and the difficulty of incorporating specific practices into existing management systems.

Nearly two-thirds of the respondents indicated that they were interested in adding some (or more) conservation practices to their management system. Several conditions or actions, needed to facilitate adoption, were identified. These included the need for proof of the effectiveness and efficiency of practices, higher profits in farming, financial and technical assistance to assist with implementation, and demonstrated need for changes to the current management system.

With respect to policy alternatives and implications, farmers responded most favourably to initiatives which feature assistance and education rather than legislation and regulation. While nearly 60 per cent of respondents preferred some form of financial assistance, less than 25 per cent listed economic factors as the key barrier to adoption. The study results indicate that increased extension, and applied research into the refinement of

conservation technologies may offer more potential for increasing adoption than increased reliance on financial incentives.

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1 INTRODUCTION

1.1 Research Problem

In recent years, politicians, planners and land managers in Canada have expressed a renewed commitment to combat soil and water degradation from agriculture. Increased recognition of the potential impacts of excessive cropland runoff on the environment, and on the sustainability of Canadian agriculture has resulted in the establishment of a number of program and policy initiatives at all levels of government. In spite of these encouraging developments, the loss of productive soil and pollution of water resources remain as serious environmental problems with far-reaching biophysical, social and economic implications (Crosson and Stout, 1983; Soil and Water Conservation Society [SWCS], 1983; Clark et al., 1985).

Concern over the degradation of soil and water resources has promoted the development of numerous technological advancements in cropping and tillage practices, and in fertilizer, herbicide and pesticide management. These new technologies, combined with the resurrection of some traditional farming methods, provide the means for using agricultural lands in ways that minimize resource degradation.

While the importance of effective technology is unquestioned, it is of little value to the individual or societal interest until it is applied (Jolly et al., 1985). In recognition of this fact, there now exists considerable interest in identifying and evaluating the factors that drive, or obstruct, the technology transfer process - in this case, the adoption and implementation of remedial and preventative measures to address soil and water degradation from agriculture.

Sociologists, economists and geographers among others have examined technology transfer from various viewpoints. Many scholars of innovation diffusion have equated adoption with awareness, believing that the implementation of new technologies results directly from the establishment of information systems. Consequently, the spread of technology focuses on extension, demonstration and community leadership (Jolly et al., 1985). The innovation diffusion process is complex involving stages of adoption as well as social and personal characteristics of adopters, and assumes that adoption and awareness are inextricably linked. Social scientists have also studied factors relating to attitude that contribute to the adoption of conservation technologies. These include opinions about land-use control, government involvement, stewardship of land and perceived needs for soil conservation (Napier and Forster, 1982; Nowak, 1983). In a system rooted in voluntary participation in soil and water conservation programs, it is generally held that positive attitudes toward conservation, and awareness of associated technologies are pre-conditions for adoption (Swanson et al., 1986).

Recent research in Ontario and the United States suggests that many farmers are sympathetic to the conservation cause, and are generally aware of both the existence of soil erosion and the methods recommended for its control (Swanson et al., 1986; Wall et al., 1985). Despite this, the adoption of conservation technology has not been widespread and land-degrading practices continue (Miller, 1984).

It is evident that positive attitudes and adequate awareness and knowledge while necessary are not sufficient to ensure widespread adoption. This suggests that other forces constrain many land managers from acting on their pro-conservation beliefs. Programs must be developed which specifically examine

these barriers to the adoption of remedial and preventative measures to address soil and water degradation resulting from agriculture.

1.2 Purpose and Objectives

This report is prepared for the socio-economic analysis component of the Soil and Water Environmental Enhancement Program (SWEEP), and is intended to contribute to water quality and soil fertility objectives for Southwestern Ontario. The broad purpose of this research project is to identify barriers to conservation in agricultural land use, and to assess prospects for their removal. The study has three objectives:

1. to identify the nature and extent of conservation practices by farmers in Southwestern Ontario,
2. to identify, characterize and evaluate the major barriers to the use of conservation practices, and
3. to consider factors which promote and/or obstruct adoption of soil conservation practices for policies and programs.

While the full range of major barriers to adoption will be explored, a matter of primary concern is the identification of barriers to adoption when levels of attitude and awareness would suggest an orientation toward conservation behaviour. The identification of these barriers or constraints will contribute to the development of 'enabling' programs designed to enhance levels of adoption.

1.3 Research Strategy

The research strategy includes a thorough review of scholarly and professional literature in the broad areas of soil and water degradation, and technology transfer; collection of primary data through a questionnaire administered by mail as well as personal contact with respondents during the

summer and fall of 1988; and use of secondary data sources to assess the nature of the study area and the representativeness of the sample. A detailed methodology is presented in Section 4.

Other sections of this report:

- establish the context and scope of the research by reporting on causes of soil degradation and available technologies to combat it,
- examine agricultural activity in the study area, including the nature and extent of conservation practices,
- identify those factors which appear to be significantly related to adoption of conservation practices,
- identify and assess barriers to adoption, and
- examine implications for soil conservation policies and programs.

2 SOIL DEGRADATION AND CONSERVATION TECHNOLOGIES

Over the past fifteen years attention has focussed increasingly on the environmental implications of production agriculture throughout North America, particularly in the Canadian and American portions of the Great Lakes Basin (for example, Battiston and Miller, 1983; Ketcheson, 1980; Miller et al., 1982). In response, a number of conservation technologies have been developed and promoted to farmers. This section establishes the need for conservation practices, and identifies the specific measures which collectively comprise 'conservation technology'.

2.1 Causes of Soil and Water Degradation

Over the past forty years, Canadian agriculture has undergone dramatic changes. The industry in the 1980s has been described by Dumanski et al. (1986) as being highly mechanized, capitalized and specialized with substantial increases in production occurring over the past decade. Much of this increased production has been achieved through the expansion of the agricultural land base (utilization of marginal areas) and the associated increased use of fertilizers and chemicals for weed and pest control. However, it is now generally accepted that such productivity gains in the agricultural sector of Canada and other developed countries have occurred at the expense of environmental quality and soil fertility. Trends in agriculture which have lead to increased soil and water degradation are listed below (Miller, 1984).

1. Abandonment of forage-based crop rotations for monoculture row crop agriculture.
2. Increasing regional specialization of agriculture with the emergence of large areas devoted to cash crop agriculture and an accompanying reduction in dairying and livestock production. Accordingly, the

diminished demand for hay crops has further reduced the use of forage in rotation.

3. Enlargement of farms and farm fields and subsequent reliance on capital-intensive technologies and purchased inputs.
4. Growing reliance on debt financing which has left many farmers vulnerable to the potentially crippling effects of high interest rates. In the interest of remaining solvent many responsible farmers have been forced to emphasize short-term cash flow.

Recent research in Canada, and particularly in Ontario, suggests that the most serious forms of degradation occurring in the Great Lakes Basin are water-induced soil erosion and associated phosphorus loss from agricultural cropland sources (International Joint Commission [IJC], 1983; Miller, 1984; Miller and Spires, 1978; Sparrow, 1984). The increase in water-induced erosion in Ontario is generally attributed to an increase in row crop production-particularly corn and soybeans - and a reduction in the production of cereal grain and hay. This is largely due to the development of shorter season corn and soybean hybrids which eventually 'out performed' other activities in terms of economic return (Miller, 1984).

Considerable research over the past two decades has examined the relationship between soil loss and yield reduction. While the specifics of this research are beyond the scope of this review, it is worthwhile to note that it is accepted that yield levels are indeed threatened by uncontrolled soil erosion (Battiston et al., 1987; Crosson and Stout, 1983). Yield reductions are not uniform, however, but relate to soil type and past erosion (Dickinson et al., 1987).

With respect to phosphorus loading, both Canadian and American authorities have concluded that phosphorus (and associated sediment) levels are too high (Baker, 1985; Baker and Laflen, 1983; Hore and McLean, 1973; IJC, 1983). The degradation of water resources is recognized as a matter of societal interest and a great deal of research currently relates to addressing these off-farm costs of soil and nutrient loss. It is now thought that the off-farm impacts of soil erosion may be much greater than any on-farm yield-related implications (Clark et al., 1985). Clearly, a wide body of research supports the notion that present rates of soil erosion and phosphorus loss from agricultural cropland in Ontario, and many areas of the United States, are too high. Adjustments are required to present farming methods in order to reduce the environmental consequences of agriculture. One response has been the development and promotion of conservation practices in agriculture. The following section briefly identifies the predominant types of remedial and preventative measures available to farmers in Ontario.

2.2 Existing Conservation Technologies

Dickinson et al. (1987) identify five broad categories of remedial measures that may be utilized to reduce soil erosion and its effects. These are:

1. tilling,
2. cropping systems,
3. surface flow control,
4. subsurface flow control, and
5. amendments.

The relative effectiveness of the remedial or preventative measures is influenced by the causes of soil erosion, and the degree to which measures are found to be acceptable by land managers. Acceptability is dependent on

affordability, profitability and complexity (Dickinson et al., 1987).

Tilling of soil has the primary functions of weed control, incorporation of pesticides/fertilizers, loosening of compacted soil and preparation of favourable seed and root beds. Unfortunately, most conventional tillage methods reduce ground cover and increase the exposure of the soil to wind and water. Alternative forms of tillage which reduce soil erosion are commonly referred to as 'conservation tillage'. These range from no-tillage to slightly modified versions of the traditional moldboard plough.

Cropping systems which offer soil conservation benefits involve a rotation which includes the return of forage to the soil. Many studies in Ontario and elsewhere have demonstrated the detrimental effect of continuous corn. Unfortunately, as noted earlier, hay crop has become a less valuable entity with the decline in livestock and dairying in many parts of Southern Ontario.

Surface flow control utilizes remedial measures which attempt to reduce velocities and concentration of runoff. Cropping and tillage practices increase the quantity, duration or timeliness of ground cover and can effectively reduce the erosive force of surface flow.

Subsurface flow control relates to the ability of water to flow through soil. Increased subsurface flow will reduce surface runoff and thus reduce erosion. The most common form of subsurface flow measures is the use of tile drainage.

Amendments to soils in Ontario are usually in the form of fertilizers or organic matter and are applied to overcome the yield-related impacts of soil erosion. Amendments differ from other conservation strategies in that they are remedial to the extent that they help mitigate the impacts of soil erosion, but have no preventative value.

It is apparent, from the literature consulted, that the most promising and promoted technologies for reducing soil erosion and sedimentation are conservation tillage and modified cropping systems (Dickinson et al., 1987). Other measures noted in this section, and many structural alternatives such as terracing, and windbreaks are also appropriate and useful in site-specific cases. It is now generally held that, despite the fact that conservation methods in farming are still evolving, suitable and desirable conservation technologies are available to - and needed by - many Ontario farmers.

Recent research in Ontario (Coleman and Roberts, 1987; Wall et al., 1985) indicates that conservation practices are currently used by many farmers. Unfortunately their use is not sufficiently widespread to combat existing soil and water problems successfully. In view of this short-fall, there is a need to discover why widespread adoption of conservation practices has not occurred, and to examine the prospects for enhancing current levels of use.

3 ADOPTION AND DIFFUSION OF CONSERVATION TECHNOLOGIES

Current knowledge of levels of soil and water degradation in Ontario, and elsewhere, suggest that the adoption of conservation technologies in agriculture is in the public interest. Despite the fact that many individuals are supportive of the conservation ethic, and are often aware of the existence of soil erosion in their area, levels of adoption have not been high (Wall et al., 1985). The adoption of conservation technology by farmers is an important environmental objective in present day agriculture. The topic has been studied within a broad methodological framework designed to assist in the study of how, and why, agricultural innovations are adopted. This literature may offer insights into the adoption of conservation technologies in Ontario.

3.1 Characteristics of Conservation Technologies

Although conservation technologies represent agricultural innovations, they differ in four significant ways from innovations which have commonly been studied in the past. The first significant difference relates to the profitability of conservation practices in farming. Whereas many innovations provide economic benefits to operators, most researchers agree that short-run profits associated with conservation technology are modest to non-existent (Swanson et al., 1986). Rogers (1983) has suggested that conservation is a preventative technology which requires an immediate action to avoid undesirable outcomes in the future. In this sense conservation technologies can be viewed as investments in the farming operation. However, as was noted earlier, debt financing and high interest rates have shortened the planning horizons of many farmers (Miller, 1984). Nowak (1984) observes that farmers must often focus on short-term cash flow in order to ensure that there is a business in the long term.

Secondly, conservation technology is not a discrete identifiable technology which is readily incorporated into existing systems. Alterations in tillage and cropping practices, for instance, entail more than the purchase of a new plough or drill. Modifications are also required with respect to fertilizer application, harvest, weed control and other aspects of the management system. Rather than 'item innovations' which are readily diffused, Nowak (1984) defines conservation technologies as 'system innovations'.

Thirdly, specific conservation technologies do not tend to be universally or even regionally applicable, but are sensitive to physical and managerial variations on a site-specific basis. Nowak (1984) observes that in the case of conservation technologies, farmers are active in their development to the extent that general concepts are modified and adapted to individual farm circumstances. Related to this characteristic of conservation technologies is the fact that they are more effectively marketed at the media level as a concept or 'ethic' because of their complexity and site-specific nature. Individual innovations which have been adapted to local conditions are thought to be more effectively promoted through personal contact and the use of demonstrations.

Fourthly, Heffernan (1984) suggests that conservation technologies differ significantly from other types of agricultural innovations because they provide relief or solutions to problems which are often not apparent or acknowledged by farmers. In addition he suggests that awareness is sometimes spatially selective. For example, many farmers are more aware of their neighbour's soil erosion problem than they are of their own.

Jolly et al. (1985) define four kinds of technologies - directly superior, indirectly superior, directly inferior and indirectly inferior. A directly

superior technology is one in which the benefits accrue directly to the adopter and the net benefits are greater than those offered by existing technologies over the decision-maker's planning horizon. In contrast, an indirectly superior technology is one in which the associated benefits do not accrue to the adopter even though societal benefits may be substantial. This classification has been used to consider the likelihood of adoption. A directly superior technology will, in most cases, be adopted while an indirectly superior technology will not be adopted unless the individual gains satisfaction from providing societal benefits. Jolly et al. (1985) suggests that an indirectly superior technology requires institutional change or public intervention to redirect the benefit flows to the adopter. If the inputs for soil conservation technology include labour, capital, and increased managerial expertise, and the output is reduced soil erosion and improved water quality, it may be argued that, unlike more traditional agricultural innovations, conservation practices may represent indirectly superior technologies to many land owners.

Largely based on the traditional importance of information in the adoption process, many policy makers and program managers interested in the promotion of conservation technology in farming have built programs around education, extension and demonstration. Recent initiatives in Ontario have also included financial and technical assistance (for example, the Ontario Land Stewardship Program). Conventional wisdom suggests that farmers, once aware of the need for, and benefits of, conservation tillage or cropping systems, will be motivated to act. Research in Ontario suggests that many farmers are indeed aware of the existence of remedial and preventative technologies but despite this, adoption has not been widespread (Wall et al., 1985). The appropriateness of the traditional concepts of adoption and diffusion when dealing with

conservation technologies may be questionable (Heffernan, 1984; Van Es, 1984).

In traditional research approaches, personal and social characteristics of farmers have been considered to be key determinants of individual adoption. Differential access to sources of information is thought to influence the spatial pattern of diffusion strongly. Traditionally, the interaction of available information and appropriate personal and situational factors is believed to result in positive attitudes toward the innovation and leads to adoption. However, as Nowak (1984) has observed, research concerned with adoption of conservation technologies has indicated that, unlike the case for other innovations, attitude and preference do not necessarily govern behaviour. The conclusion of many researchers is that other factors not included in the traditional model are constraining many land owners from acting in ways which are consistent with their attitudes and beliefs.

3.2 Adoption and Diffusion Research

Increasingly, researchers have examined factors which are thought to impact on the adoption of conservation practices. Unfortunately, little of this work has occurred in Canada. This research project and others included in the Soil and Water Environmental Enhancement Program (SWEEP) should address this deficiency.

While awareness of erosion and available technologies is generally thought to be quite high in Ontario, Ervin and Ervin (1982) conclude that in many cases, farmers may be aware of the wrong things relating to soil conservation. From an adoption perspective it matters little if farmers are keenly aware of the seriousness of soil and water degradation generally if they fail to recognize problems that may exist on their own farm. Additionally, Korsching and Nowak (1984) found that many farmers greatly over-estimated their

conservation effort. The basic conclusion of this research was that differences may exist between estimated and actual conservation achieved.

Research has been directed at understanding how the other farm level factors contribute to farmers' use of conservation practices. Swanson et al. (1986) place these factors into three broad categories:

1. sources of information,
2. personal characteristics, and
3. farm structure factors.

Alternatively, Culver and Seecharan (1986) place adoption-related factors in the following categories:

1. physical: topography, soil, micro-climate, farm size, etc.,
2. economic: discount rate, income, debt, access to credit, etc.,
3. personal: age, education, attitude, orientation toward risk, etc.,
4. type of farm: ease of integration of conservation practices,
5. type and form of information: timeliness, clarity, etc., and
6. availability of solutions: effectiveness, complexity, cost, etc.

These categories agree well with those identified by Ervin and Ervin (1982) in their study of farmers in Missouri. A broad body of literature exists which addresses the impact and significance of the factor groups noted above. While findings vary, there does appear to be a consistency in the literature which may be used to guide the selection of potentially influential factors in this study. It is well accepted that adoption should be studied in concert with a range of farm, farmer, and farm business characteristics. Subsequent sections utilize these general findings to assist in the development of the research approach.

Beyond identifying factors which may influence adoption some researchers consider the issue of type and intensity of conservation practice use. Others (for example, Ervin and Ervin, 1982) now question the validity of past approaches to measuring the 'amount' of conservation achieved. While some studies have simply counted practices, this assumes that all conservation practices are of equal value. Most researchers agree that this is an unrealistic assumption.

Other examinations of conservation technology adoption have focussed on the adoption of specific practices - most often tillage (Napier et al., 1984). While it is generally held that tillage represents one of the most significant areas in conservation technology, it is questionable whether these results can be extrapolated to all practices. Nowak (1987) found that factors which significantly influence the adoption of various reduced tillage systems differ from factors related to other practices which are less profitable. Similarly, Pampel and Van Es (1977) report that farmers tend to be innovative with respect to either commercial innovations or environmental innovations but not both. Hooks et al. (1983) suggest that conservation technology becomes a commercial innovation when farmers begin to experience yield reduction associated with uncontrolled soil erosion. Under these conditions, soil erosion represents an on-site cost and consequently the monetary value of the technology is increased.

The issues discussed in this brief review introduce the 'farm-level' factors generally thought to promote or obstruct the adoption process. These represent the basic 'grist' of most sociological and economic research in this area. It should be noted that micro-level analysis is now being supplemented and complimented by macro-level research into the political, economic and

sociological forces which enhance or obstruct the adoption of conservation practices in agriculture (for example, Buttel and Swanson, 1986; Manning, 1988).

4 METHODOLOGY

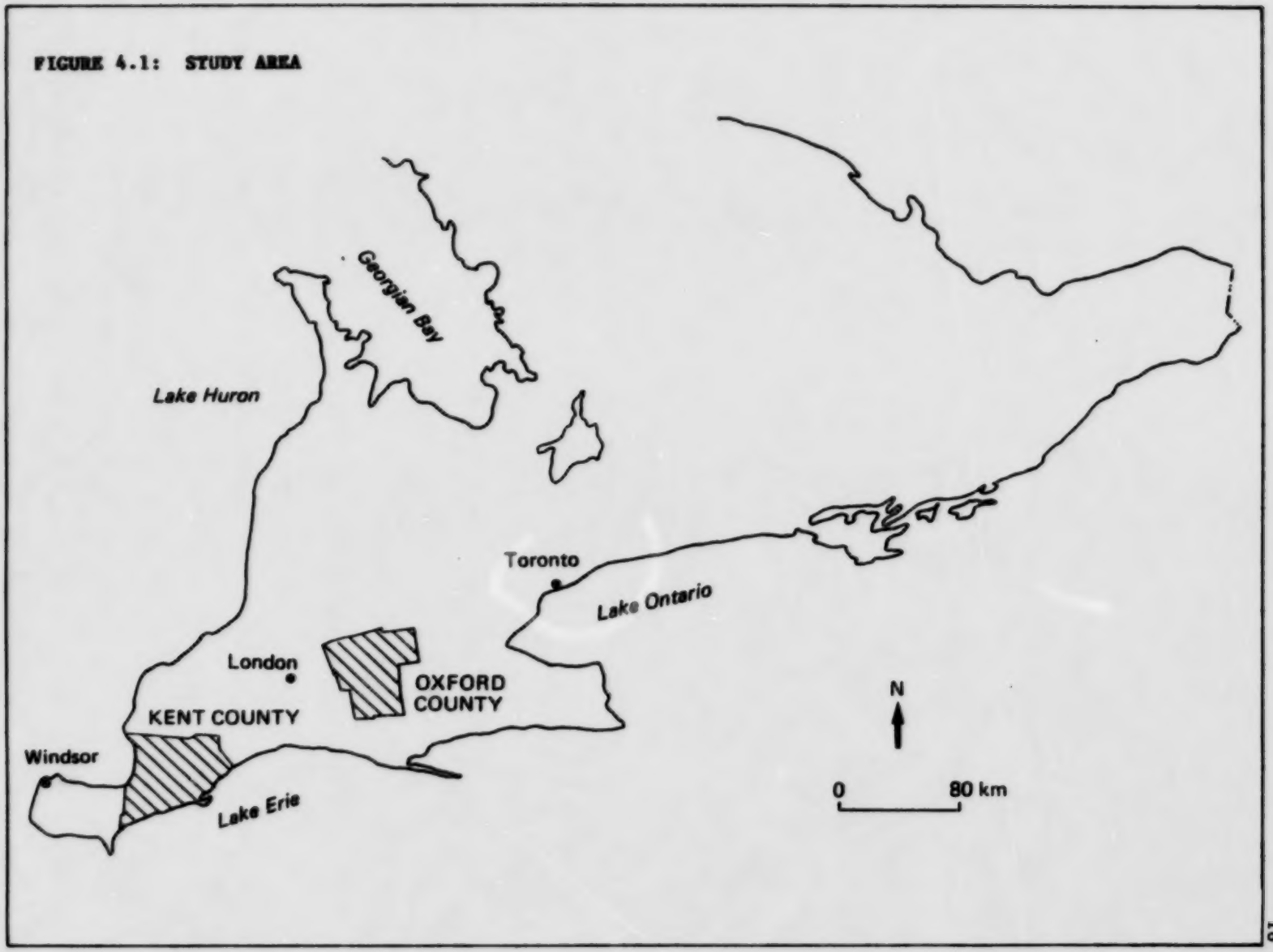
The purpose and objectives of this study were introduced in Section 1. While some research in Ontario has examined the use of conservation practices by farmers (for example, Coleman and Roberts, 1987; Wall et al., 1985), the subject of barriers to adoption has not been addressed in detail. This study represents an empirical investigation of the use, and promotion, of conservation practices among Southwestern Ontario farmers. The research involves the collection and analysis of information on farms and farmers so as to provide insights into both the nature of barriers to adoption, and the prospects for their removal.

4.1 Study Area

In response to the seriousness of soil and nutrient loss in Southern Ontario, the Soil and Water Environmental Enhancement Program (SWEEP) has as its objectives, the protection of soil productivity and the reduction of phosphorus loading from agriculture in the Lake Erie Basin. The selection of a study area recognized both the mandate of SWEEP, and the need to represent, to the extent possible, a range of topographical conditions, soil types, agricultural activities, and management practices which exist in Southwestern Ontario agriculture. In view of these requirements, the counties of Kent and Oxford were deemed appropriate (Figure 4.1).

Kent County comprises predominantly level, low-lying, fine-textured soils. The predominant physiographic regions of the county are the Bothwell Sand Plain and the St. Clair Clay Plains which include the highly fertile soils of the Chatham Flats (Chapman and Putnam, 1984). Agriculture is the dominant land use in Kent County with 2,804 farms (sales over $2,500) and 543,524 acres of farmland in 1986 (Ontario Ministry of Agriculture and Food

FIGURE 4.1: STUDY AREA



[OMAF], 1987a). Over 2,000 farms report sales in excess of $25,000 annually. While a variety of farm types is present, 74 per cent of farms are categorized as wheat and grain producers, with over 400,000 acres devoted to the growing of grain corn and soybeans (Table 4.1). These figures highlight the importance of cash crop agriculture in the county.

In contrast, the county of Oxford has predominantly medium to coarse-textured soils on rolling or undulating topography. The main physiographic features are the Oxford Till Plain in the northern portion of the county, and the Mount Elgin Ridges to the south. While the loam soils of the Oxford Till Plain are generally well-drained, gently sloping and low in stoniness, the ridges and vales of the Mount Elgin Ridges contrast well-drained clay till with imperfectly drained silt loam, sand pockets and muck (Chapman and Putnam, 1984). As in Kent County, agriculture represents the dominant land use and economic activity in Oxford. In 1986 2,327 farms reported sales of $2,500 or more; 1,762 farms reported sales in excess of $25,000. In contrast to Kent County however, there is a wider range of farm types, with significant activity in dairying, wheat and grains, hogs, and beef cattle (Table 4.1). Grain corn remains as the most frequently grown field crop, but other crops including hay are significant (OMAF, 1987b). While cash crop farming is practiced in Oxford County, it is apparent that the agricultural complexion of the county is integrated and diverse with significant involvement in both cash crop and livestock based farming.

4.2 Data Sources

The completion of this research project required information on the characteristics of farms, the personal characteristics of producers, management practices, and attitudes toward land stewardship and conservation practices in

TABLE 4.1: AGRICULTURAL CHARACTERISTICS OF STUDY AREA

Characteristics	Kent	Oxford
Farm Population	8,795	8,655
Number of Farms		
Sales > $ 2,500	2,804	2,327
Sales > $25,000	2,079	1,762
Major Farm Types		
Cattle	138	292
Dairy	11	650
Hogs	153	325
Wheat and Grains	2,083	526
Fruit and Vegetables	230	58
Total Area on Farms (Acres)		
Total Area	543,524	418,619
Cropland	502,370	340,334
Grain Corn	198,731	156,671
Silage Corn	8,244	25,992
Soybeans	201,877	21,875
Winter Wheat	51,257	17,941
Hay	5,356	54,274
Fruit and Vegetables	23,458	4,735
Improved Pasture	7,082	17,087
Other	6,365	41,809
Livestock		
Hogs	113,629	256,760
Cattle and Calves	23,791	108,227

Sources: OMAF, 1987a and 1987b.

agriculture. While selected elements of the required data were available, in summary fashion from secondary sources, most of this information was insufficient for the desired level of analysis. Alternate sources of primary data were inaccessible because of confidentiality requirements. Thus a mail questionnaire, interviews with selected respondents, and secondary sources of

information were utilized to generate the necessary data.

4.3 Sample Frame

The development of a sample frame for the project required the identification of practising farmers in both Kent and Oxford Counties, from whom it was proposed to draw a random sample for survey purposes. It was anticipated that a comprehensive 'listing' of practising farmers would be available from various sources. Consequently, the development of the sample, while of great importance, was not envisioned as one of the more time consumptive components of the study. Unfortunately, several of these potential sources could not be utilized because of confidentiality requirements and access to information stipulations. Following the exploration of a number of alternatives a satisfactory solution was obtained.

In Kent County a randomly selected list of 272 farmers was derived from a master list of approximately 2,400 producers who had participated in OMAF's Crop Stabilization Program. This master list included over 85 per cent of producers with sales over $2,500 and was felt to be sufficiently comprehensive to ensure a representative sample. Unfortunately the corresponding source was unsatisfactory in Oxford County because of the absence of dairy farmers from available records. Ultimately a listing of producers was obtained with the assistance of the Oxford County Department of Planning and Development. A computer-based list of over 2,300 names and addresses was generated from county assessment records, and provided the source for a random sample of 250 producers.

In the interest of enhancing response rates to the questionnaire, an introductory letter to members of the sample (Appendix A) provided an explanation of the nature and purpose of the research, extended an invitation

to participate, and offered an opportunity to be removed from the mailing list. The purpose of this latter component was to allow persons who had been incorrectly identified as practising farmers to withdraw from the study.

4.4 Questionnaire Design and Administration

4.4.1 Questionnaire Design

A number of research techniques and structural considerations were explored prior to the development of the final questionnaire. Comments and suggestions were sought from faculty in the Departments of Geography and Land Resource Science at the University of Guelph, county staff of OMAF, Conservation Authority personnel with expertise in the area of conservation practices, practising farmers, and Agriculture Canada.

The Conservation Practices Questionnaire (Appendix B) consisted of three sections and included both closed and open-ended questions. Part A was designed to collect information on the size and nature of the farming business, and the physical characteristics of the farm, and to illicit responses on a variety of agricultural issues. The purpose of these questions was to determine the orientation of respondents towards soil degradation as an agricultural issue, and equally importantly, to generate interest in - and momentum for - the completion of the questionnaire.

Part B of the questionnaire focussed on conservation practices by examining the farmers' awareness, sources of information, and number and type of practices used. The section concluded with a series of open-ended questions regarding reasons for the use of practices, barriers to adoption and necessary conditions for increasing or initiating the use of conservation practices.

The final section of the questionnaire was designed to obtain personal information on farmers, and economic information on the farm business in order

to assist in the identification of relationships between farm/farmer characteristics and the use of conservation practices. Section C concluded with questions relating to possible actions by government in the promotion of conservation practices in farming. Information gained in these questions contributed to a discussion of policy and program alternatives at the conclusion of this report. Finally, producers were given the opportunity to request a summary of results and were asked if they would consent to further contact.

4.4.2 Questionnaire Administration and Follow-Up

Upon approval of the draft questionnaire by Agriculture Canada in late August, a total of 501 questionnaires were mailed to farmers in the study area (Kent - 258, Oxford - 243) with 13 questionnaires returned as undeliverable. Approximately three weeks after the distribution of the questionnaire a letter prompt was sent to non-respondents. By mid-October a total of 180 questionnaires had been returned (Kent - 106, Oxford - 74), providing a response rate of 36.9 per cent. Sheskin (1985) suggests that this represents a more than adequate response rate. (Unfortunately four questionnaires were found to be unsuitable because of significant omissions and were not utilized in the analysis).

Preliminary analysis of returned questionnaires prompted a change in the proposed methodology of the study. The open-ended questions, posed in Part B of the questionnaire, were not well answered by most respondents. As this information was deemed essential to the successful completion of the research it was decided that the originally planned telephone prompts and limited number of personal interviews would be replaced by telephone interviews with all respondents (a small number were omitted because of the high quality of information provided, or a refusal of further contact). The purpose of these

interviews was to explore in detail, the issue of barriers to adoption of conservation practices, and to identify the means by which these barriers could be overcome. In addition, the telephone interviews provided an opportunity for the validation of information which had been provided. While this approach represented a deviation from the originally proposed methodology, it provided an effective and rigorous means of collecting the necessary data for the analysis.

Finally, an attempt was made to assess the representativeness of respondents for both general characteristics and conservation practice use. The later was accomplished by examining the nature and extent of conservation practice use by non-respondents in an effort to ensure that practice use was not over-represented in the basic data. This was accomplished through telephone interviews with 45 non-respondents. The rationale for, and results of, this exercise are discussed in Section 6.

5 CHARACTERISTICS OF FARMS AND FARMERS

To provide a context for subsequent analysis of the nature and extent of conservation practice use in the study area, it is useful first to examine the information obtained from the sample on both farms and farmers.

5.1 Attributes of Farms

The data presented in Table 5.1 describes the size, type and physical conditions of farms for which information was obtained. The average size of farm operations in the study area is 215 acres, however size of farm operation is highly variable. The most frequently reported farm size is 100 acres.

In addition to farm size, respondents were asked to indicate the amount of the total farm operation which was owned, and the amount rented from others. These totals are presented in Table 5.1. It must be noted that most farmers did not report any rented land. Obviously the average amount of rented land is greatly influenced by a small number of observations, and does not accurately reflect the nature of land rental.

Producers were asked to classify their farm by type according to major enterprise. As expected, cash crop was the most frequently identified type of farm operation at nearly 75 per cent. Swine operations were the next most frequently reported farm type, and were followed by beef, dairy, fruit and vegetables, and 'other' (Table 5.1). The category 'other' included poultry, sheep, tobacco, mixed, and trees/nursery stock with fewer than five observations each.

The predominance of cash cropping as a farm type was expected in view of other available census and survey data. This finding was substantiated by data pertaining to the use of cropland. Respondents were asked to specify the type and acreage of crops grown on the land they farmed in 1988. While specific

TABLE 5.1: ATTRIBUTES OF FARMS

Size of Farms

Mean Farm Size	215.4 acres
Range	795.0 acres
Most Common Size	100.0 acres
Average Acres Owned	158.5 acres
Average Acres Rented	53.4 acres

Farm Types	Sample
Total Farms	176 (100.0%)
Cash Crop	129 (74.0%)
Swine	29 (16.5%)
Beef	24 (13.6%)
Dairy	20 (11.4%)
Fruit and Vegetables	16 (9.1%)
Other	27 (15.3%)

Note: Percentages may not add to 100 as some respondents recorded more than one major enterprise.

Major Crops	Total Acres	Average Acres	% Total Area
Row Crops	26,146	150	72
Grains	6,500	37	18
Forage	2,850	16	8
Other	673	4	2

Soil Texture	Total Acres	Average Acres
Coarse	4,324	25
Medium	11,394	65
Fine	15,312	88
Organic	410	2

continued

TABLE 5.1 continued

Attribute	No. of Farms	% of Farms
Slope		
Flat Land	91	52
Rolling Land	79	45
Steeply Sloped	6	3
Soil Conditions		
Erosion:	121	69
Water	65	54
Wind	22	18
Both Types	34	28
Compaction	74	48
Poor Soil Structure	37	29
Lack of Available Water Holding Capacity	26	20
Loss of Organic Matter	31	23
Decline in Fertility	20	15

crop types were recorded on the questionnaire, they were subsequently grouped into four classes for data storage, presentation and analysis purposes. The categories of row crops, small grains, forage and other were felt to be the most appropriate given the intent of the research and the nature of the analysis.

Cropping intensity, which is closely related to levels of degradation, is calculated as the proportion of each farm which is devoted to the production of row crops. On average, over 70 per cent of each farm was used in this manner.

Information pertaining to soil texture, slope, and soil conditions is displayed in Table 5.1. Most farms were reported as flat to rolling, composed of medium to fine-textured soils, and subject to minor or moderate levels of erosion. Many respondents reported other soil problems in addition to erosion on their farms. The most common of these was soil compaction.

5.2 Farmers' Perceptions and Sources of Information

Respondents were questioned regarding their familiarity with the soil conservation benefits of practices included in the questionnaire, and the sources of information that they had utilized to obtain this information. Existence of reported awareness regarding practices was extremely high. Nearly 95 per cent of farmers indicated that they were familiar with at least some of the soil conservation practices listed. Unfortunately, it is not possible to draw conclusions regarding the 'level' of awareness among survey respondents. The most commonly reported source of information on conservation practices was the news media. The frequency of other sources of information is detailed in Table 5.2.

In order to examine issue priorities, farmers were offered a list of, what are held to be, existing or emerging issues in agriculture. They were asked to select those issues which they felt were particularly important to farmers in Southwestern Ontario. The results presented in Table 5.2 indicate the number of farmers who selected each potential concern. It is interesting to note that soil erosion was identified by fewer than 40 per cent of respondents. While the level of concern over erosion corresponds well with several of the issues identified, it is greatly surpassed by economic concerns relating to farm product prices. The significance of this will be developed later in the report.

5.3 Attributes of Farmers

Information relating to the age and education levels of respondents is contained in Table 5.3. In addition, data obtained on farmers' membership in farm organizations, and their intergenerational expectations regarding continuing family involvement in the farm business are presented.

TABLE 5.2: AWARENESS AND PERCEPTIONS

Awareness	No. of Respondents (%)
Awareness of Practices	
Familiar with Conservation Benefits of Questionnaire List	167 (95)
Sources of Information	
News Media	120 (70)
Neighbours	73 (43)
Soil and Crop Improvement Association	54 (31)
Agricultural College	48 (28)
OMAF Representative	37 (22)
Conservation Authority	24 (14)
Farm Machinery Dealers	22 (13)
Other	19 (11)
Agricultural Concerns	
Farm Product Prices	146 (84)
Soil Erosion	68 (39)
Water Pollution	65 (37)
Other	62 (35)
Climate Change	59 (34)
Free Trade	58 (33)
Declining Interest in Farming Among Young People	40 (23)
Availability of Credit	30 (17)
Urban Expansion	24 (14)

Membership in farm organizations has been proposed as a factor which may influence conservation behaviour. Over fifty per cent of respondents indicated that they were affiliated with a farm organization. While the organization was specified in most cases, this information was not entered in the computer data base as it was not required for analytical purposes. It was used however to validate responses. The most frequently noted organizations were the Ontario Federation of Agriculture, the two Soil and Crop Improvement Associations and various producers' associations.

TABLE 5.3: ATTRIBUTES OF FARMERS

Attributes	No. of Respondents (%)
Age[1]	
20-30 years	15 (9)
31-40 years	26 (15)
41-50 years	56 (32)
51-60 years	49 (28)
61-70 years	22 (13)
Over 70 years	6 (3)
Education[2]	
Elementary	29 (17)
Secondary	92 (54)
Post Secondary	51 (29)
Membership in Farm Organizations	100 (58)
Intergenerational Expectation	107 (62)

1 Missing values = 2.

2 Missing values = 4.

Note: Average length of farming career - 28 years.

It is generally accepted that length of 'planning horizon' is associated with use or non-use of conservation practices. While planning horizons are most often influenced by economic factors, they may also be related to expectations regarding the continuity of family involvement in farming. Respondents were asked if they were hopeful that a member of their family would one day assume control of the farm business. Slightly more than 60 per cent indicated that they would like to see a continuation of the farm business within the family. However, many of these individuals, without solicitation, added that they did not believe that this would occur because of low profits

associated with farming.

5.4 Economic Attributes of Farm Businesses

Three financial questions were asked in the interest of developing a very basic understanding of the economic status of farm businesses. In view of the potential sensitivity of requesting financial information, data were collected and recorded in broad categories only. Table 5.4 contains information relating to equity level, off-farm income, and gross farm sales.

Interestingly, most respondents claim to possess a relatively high equity level. This condition, if accurate, contrasts with common perceptions and with census and farm credit corporation data to the contrary.

The involvement of off-farm income in soil conservation investments is difficult to interpret. While some researchers contend that reliance on off-farm income is symptomatic of financial need and a possible lack of profitability in the farm business, others believe that it represents the likelihood of increased discretionary income for investment in conservation practices. For the purposes of this study it is hypothesized that increasing levels of off-farm income suggest a decline in the importance of, or emphasis on farming.

It was hoped that information on gross sales would provide insights into both the scale and profitability of farming in the study area. In contrast to the uncertain influence of off-farm income, increasing levels of sales are usually hypothesized to be positively related to conservation practice adoption. Farm sales were placed in the six broad categories outlined in Table 5.4. While the categories were quite broad it was thought that the pursuit of more detailed information might discourage response. The information collected proved to be satisfactory for analytical purposes.

TABLE 5.4: ECONOMIC ATTRIBUTES

Attributes	No. of Respondents (%)
Equity Level[1]	
< 25 %	8 (5)
25% - 50%	25 (15)
51% - 75%	28 (16)
> 75%	109 (64)
Off-Farm Income[2]	
< 10%	86 (50)
10% - 25%	19 (11)
26% - 50%	19 (11)
51% - 75%	21 (12)
> 75 %	26 (15)
Gross Farm Sales[3]	
< $25,000	25 (15)
$ 25,000 - $ 50,000	28 (17)
$ 50,001 - $100,000	40 (24)
$100,001 - $150,000	39 (23)
$150,001 - $200,000	15 (9)
> $200,000	20 (12)

[1] Missing values = 6.

[2] Missing values = 5.

[3] Missing values = 9.

This section has introduced results which were used to describe and assess the survey sample. Many of these results will be utilized during the analysis of adoption of conservation practices, undertaken in Section 7.

6 USE OF CONSERVATION PRACTICES

This section examines the nature and extent of conservation practice use in the study area, and develops an index of conservation practices.

6.1 Data Considerations

Before proceeding with a description of the use of specified conservation practices, it is appropriate to account briefly for the composition of the range of practices which are presented in the research instrument. The selection of conservation practices, for inclusion in the questionnaire, was guided by the conventional scholarly and professional literature relating to conservation technologies and practices in agriculture, the findings and conclusions of recent research in Ontario (for example, Coleman and Roberts, 1987; Wall and Driver, 1982; Wall et al., 1985), and researchers at the University of Guelph and elsewhere.

In particular, the study utilized the work of Dickinson et al. (1987) who examined both the nature and extent of soil degradation in Southwestern Ontario, and the effectiveness and availability of various remedial and preventative measures. The measures specified in this study are listed below:

1. conservation tillage (chisel plow, soil saver, ridge till, etc.),
2. modified moldboard plough (increased residue),
3. use of forage and/or small grains in rotation,
4. cover crop,
5. plowdown crop,
6. bufferstrips,
7. grassed waterways,
8. windbreaks,
9. drop inlets,

10. tile outlet protection, and

11. other (including manure/fertilizer management).

While respondents were provided with an opportunity to indicate any 'other' practices which they felt were contributing to a land stewardship effort, they were specifically asked to include manure and fertilizer management in this category. Such practices were included in the category 'other' because it afforded respondents the opportunity to elaborate on the nature of these measures, and permitted the screening of responses during data classification and coding. This was deemed necessary because of the potential complexity of this variable.

6.2 Type and Extent of Conservation Practice Use

Data obtained from returned questionnaires, and from telephone interviews with respondents, were used to develop a profile of the nature and extent of conservation practice use in the study area. Table 6.1 presents findings relating to, the use of conservation practices in the study area (overall and by county), as well as the broad timeframe over which practices have been in use.

Conservation tillage reduces the frequency and intensity of tillage, while increasing the amount of crop residue retained at the soil surface. These systems feature the use of specifically designed tillage implements such as the chisel plough or soil saver, and/or the use of tillage techniques such as ridge till and strip cropping. Nearly 40 per cent of survey respondents indicated that they had adopted conservation tillage on the land that they farmed. This practice was used by a higher percentage of Kent County respondents (48 per cent) than by Oxford County respondents (27 per cent). Available temporal data indicated that most adoption of this practice (72 per cent) had

TABLE 6.1: USE OF CONSERVATION PRACTICES

Practice	% Use by All Respondents	% Use by Kent Respondents	% Use by Oxford Respondents	% Recent Adopters[1]
Conservation Tillage	39	48	27	72
Modified Moldboard Plough	40	47	30	40
Crop Rotation	73	68	79	17
Cover Crop	38	38	36	32
Plowdown Crop	47	52	37	21
Bufferstrips	9	8	10	38
Grassed Waterways	24	15	36	36
Windbreaks	33	40	21	29
Drop Inlets	19	28	6	45
Tile Outlet Protection	39	46	27	22
Other (manure/ fertilizer management)	14	13	16	36

[1] % of users in both counties who have adopted only in last 5 years.

Note: Mean number of practices - Kent = 4.0, Oxford = 3.3.

occurred in the last five years. This may reflect the increased promotion of tillage as an important method of soil management, and the ever increasing availability of rental opportunities for experimentation with alternative tillage techniques.

Reduced tillage with moldboard plough was included as a conservation practice in recognition of the potential soil conservation benefits associated with the modification of traditional tillage implements (moldboard) to substantially reduce the amount of residual burial. These measures are often accompanied by a reduction in the amount of secondary tillage for maximum soil conservation benefits. While a significant percentage of respondents (40 per cent) reported the adoption of a modified moldboard/reduced secondary tillage system, telephone interviews revealed that some individuals who indicated this method on the questionnaire did so if they used a moldboard plough regardless of the reduced tillage condition. Confirmation with respondents indicated that most misinterpretation of this variable occurred in that portion assigned to 'always used'. While it appears that most respondents, who indicated recent adoption of a modified moldboard system, correctly interpreted the significance of the practice, some admitted to a low level of residue retention, thus diminishing the conservation value of the practice.

Rotation, which includes forage or small grains, provides substantial soil conservation benefits. This measure was the most frequently reported by respondents at 73 per cent, with slightly higher use in Oxford County. Interestingly, a very low percentage of respondents indicated that crop rotation represented a recent change to the management system. This would appear to be at variance with the reported predominance of monoculture systems in Southwestern Ontario (particularly Kent and Essex Counties) over the past two decades. It is possible that some of these individuals have returned to rotation, but that this change was not captured in the 'last 5 years' category.

Plowdown and cover crops provide soil conservation benefits by improving soil conditions and protecting the soil surface respectively. Plowdown (usually

red clover) was reported by nearly half of survey respondents and was more prevalent among Kent County farmers than Oxford County farmers. Nearly 80 per cent of producers who reported the use of plowdown indicated that they had done so for more than five years.

The use of a cover crop (e.g., winter wheat) was reported slightly less often than plowdown. In disaggregating results by county it does not appear that location was a significant determinant of the use of a cover crop. Like plowdown, most reported that adoption of a cover crop for soil conservation purposes occurred before 1983.

Other conservation practices which were reported by significant numbers of respondents were tile outlet protection (nearly 40 per cent) and windbreak plantings (33 per cent). Both practices were reported with greater frequency by Kent County producers. This is consistent with what would be expected given the topography and predominant soil types in Kent County as well as the relative paucity of remaining natural woodlots.

Finally, the data indicate that, with the exception of tillage-related practices, most adoption occurred before 1983. While this might be interpreted as a 'slowing' of the rate of adoption of conservation practices, the strong increases in conservation tillage adoption over the past five years suggest that it is more likely reflective of the recent dominance of tillage in conservation technology, promotion and research. Such a conclusion is speculative but also consistent with recent and on-going research priorities and program initiatives vis-a-vis conservation technologies, where tillage and cropping systems are recognized as the salient features of an effective conservation effort.

6.2.1 Representativeness of Sample

The generation of an initial sample frame is a random exercise. Potential respondents however, select themselves for participation in a research project, by choosing whether they will or will not, return a completed questionnaire. In effect, the end result is a sample of farmers who chose to provide information. This inherent characteristic of survey research is often accepted by necessity, and is not usually thought to compromise the validity of either raw data or analysis.

To the extent possible, the representativeness of data should be checked against existing data from secondary sources. This was done earlier in the study with respect to farm types. Unfortunately, secondary data for validation purposes are not always available or comparable. In view of the comparatively high levels of reported use of conservation practices in the study area it was decided to attempt to utilize both primary and available secondary data to check the representativeness of the survey sample on this dimension.

Two studies conducted in Ontario over the past five years have examined the use of various conservation practices by Southwestern Ontario farmers (Coleman and Roberts, 1987; Wall et al., 1985). However, as the selection and definition of conservation practices, and the method and time of data collection differ significantly between the two surveys and this research, the quantitative results obtained appear to be poorly suited to meaningful comparison.

Alternatively, it was decided that a random sample of non-respondents, from the study's original mailing list, would be identified and interviewed for the purposes of ascertaining the number and types of conservation practices in use among this group. The appealing feature of this approach to data validation was, the retention of a high degree of consistency in methods and,

the compatibility of results. It was felt that a sample of approximately 50 non-respondents, would provide the basis for a valid comparison of levels of conservation practice use, and would reveal whether farmers who use more practices are over or under-represented in the sample.

The survey of non-respondents was undertaken in mid-November 1988 via telephone, with 45 interviews completed (Kent - 23, Oxford - 22). Data were obtained on the number and type of conservation practices used, and on the conditions or actions that would enhance or facilitate additional adoption of practices. This latter information will be utilized in Section 8 of the report. The results of this exercise are presented in Table 6.2. While aggregate percentages by practice agree well with the original sample, the amount of adoption reported in the 'always used' category was very high. Like the original sample, tillage was the exception.

A simple counting of practices among both groups revealed that survey respondents used an average of 3.8 practices on their farms while non-respondents used an average of 3.5 practices. While this level of practice use appears quite comparable, a difference of means test (t-test) was conducted to examine the relationship. The result of this procedure (at both the 90 and 95 per cent confidence level) was that no statistically significant difference was found between the two groups in terms of the number of conservation practices used.

6.3 Measurement of Conservation Effort

6.3.1 Development of Conservation Practices Index

Information presented to this point indicates that the adoption of conservation practices cannot reasonably be measured as a binary (yes/no) variable. While it was anticipated that the majority of respondents would use

TABLE 6.2: USE OF CONSERVATION PRACTICES AMONG NON-RESPONDENTS

Practice	% Use by Mail Non-Respondents	% Recent Adopters[1]
Conservation Tillage	36	29
Modified Moldboard Plough	29	0
Crop Rotation	89	3
Cover Crop	40	3
Plowdown Crop	49	0
Bufferstrips	9	0
Grassed Waterways	18	0
Windbreaks	43	0
Drop Inlets	4	0
Tile Outlet Protection	33	0
Other (manure/fertilizer/ management)	0	0

[1] % of users who have adopted only in last 5 years.

Note: Mean number of practices = 3.5.

one or more practices from the list provided, findings from recent research also suggested that a significant number of respondents would not have adopted any of these practices (Wall et al., 1985). Surprisingly, only 10 of 221 farmers from whom information on adoption of practices was obtained, indicated that they did not use any conservation practices at all. Clearly, the variation in farmers' conservation involvement must be examined with respect to 'levels of adoption' and not as discrete user/non-user categories. It should be noted

that binary approaches have been used successfully in assessments relating to specific conservation practices (usually tillage). As noted earlier however, the validity of extrapolating these results to account for the total amount of conservation achieved is questionable.

In this project it was decided that a full range of conservation practices would be included for analysis. The nature of the data collected, suggested that the development of a rating of conservation practice use would provide an indication of the level of conservation effort among respondents and would facilitate analysis of constraints in adoption.

A number of options were considered during the selection of a measurement technique for the dependent variable - use of conservation practices. While it was possible to treat the variable in ratio form and simply record the number of practices used, other authors have questioned the validity of this approach. A grouping of respondents, based on number of practices used, was also considered. While the collapsing of the number of practices used into nominal categories represented an improvement from a logical perspective, the method also assumed that all listed practices were of equal value. It has been noted already in this report, that tillage and cropping practices are generally held to represent the salient elements of conservation technologies or practices. The assignment of equal weighting to all practices was rejected for this reason.

In recognition of the importance of tillage and cropping practices as methods of soil conservation, some consideration was given to a classification system based solely on the adoption of these two practices. This method was also rejected because it failed to recognize the legitimate soil conservation and water quality benefits of the other types of conservation practices which

many respondents use.

Ultimately, the classification method selected was one which both acknowledged the key importance of conservation cropping and tillage practices, and also assigned a conservation value to all recorded practices. A system was devised in which respondents were assigned to one of four classes or levels of conservation practice use based on the number and type of practices used. The levels and associated decision rules are as follows.

1. Level 1 - have adopted both a conservation tillage and conservation cropping system, as well as any number of other conservation practices.
2. Level 2 - have adopted one of conservation tillage or crop rotation, and at least three other conservation practices.
3. Level 3 - have adopted one of conservation tillage or crop rotation, but less than three other conservation practices.
4. Level 4 - have not adopted either the use of conservation tillage or a crop rotation which includes forage or a small grain. (While most members of this group have adopted some practices, it will also include the ten non-adopters identified earlier).

For purposes of the analysis, conservation tillage systems include the use of tillage implements and practices (as listed in Appendix B) designed specifically to reduce or eliminate residue burial and soil disturbance. Use of a modified moldboard plough is excluded from this category because of the inconsistent interpretation of the practice as discussed earlier. Efforts were made during the interview process to ensure that conservation tillage users met or exceeded the recommended 20 per cent residue retention guidelines.

Although it is believed that the use of this procedure for classifying respondents' conservation behaviour captures the importance of both the type and

number of practices used, it is not suggested that the method provides an absolute 'measure' of adoption. However, the method is based on principles which are supported in both literature and conventional wisdom, and provides a useful means of assessing farmers' conservation efforts relative to one another. This dependent variable represents an independent measure which will be compared to a range of physical, personal, managerial and economic factors to examine and account for variation in conservation practice use.

6.3.2 Results

The classification scheme was applied to the data set for survey respondents, and to the data collected from non-respondents. The resultant levels are presented in Table 6.3. In both the mail respondent data, and the non-respondent data, the largest proportion of farmers occurred in Level 3. Recall that these individuals reported that they have adopted one of either conservation tillage or crop rotation (forage and/or small grain) and up to two other conservation practices from those presented in the questionnaire. The next largest group in both data sets is Level 1 followed by 2 and 4 respectively. It is interesting to note that the two surveys agree well with respect to both the order of farmer groups, and the proportions of the samples assigned to each level. This increases confidence that the original respondent data provide a representative depiction of conservation practices.

The next two sections of this report utilize the index of conservation practices to examine factors influencing adoption of conservation practices, and perceived barriers to adoption.

TABLE 6.3: LEVELS OF CONSERVATION PRACTICE USE

	% Mail Respondents	% Mail Non-Respondents
Level 1	27.4 (48)[1]	31.1 (14)
Level 2	24.6 (43)	26.7 (12)
Level 3	33.1 (58)	35.6 (16)
Level 4	15.3 (27)	6.7 (3)
	N = 176	N = 45

[1] Number of observations.

7 FACTORS INFLUENCING CONSERVATION PRACTICE USE

7.1 Reasons for Adoption

Farmers adopt conservation practices for a variety of reasons (Table 7.1). Some relate to direct conservation objectives, others are associated with production or profit objectives. As noted previously, nearly all respondents (95 per cent) indicated that they use at least some conservation practices on their farms. These individuals were asked what had prompted them to include these practices in their management systems.

The most frequently stated reason for adoption was a concern over the long-term productivity of the soil resource. Over 60 per cent of adopters indicated that they considered these practices to be a long-term investment in the sustainability of the farm. The second most frequently stated reason for adoption was the immediate need to address a soil problem. This rather immediate concern was noted by 26 per cent of adopters. Other adopters suggested reasons for adoption which included economics in lower costs of production (16 per cent), an interest in improving soil structure and tilth (15 per cent) and a basic orientation toward land stewardship (11 per cent). A small number of producers observed that declining prices for many cash crops may encourage the use of more forage and small grains in rotation.

Interestingly, a frequently stated reason for adopting conservation practices (22 per cent of adopters) related to the farm type. Many individuals indicated that some conservation practices were used because they constitute an integral component of the management system. These respondents were most often beef or dairy producers who were accounting for the use of forage and/or small grains in rotation. For these, and perhaps many farmers, the conservation benefits provided by the practice were a fortunate secondary effect rather

TABLE 7.1: REASONS FOR ADOPTION

Reason	No. of Adopters	% of Adopters
Concern Over Long-Term Productivity	93	62
Immediate Soil Problem	38	26
Component of Existing Management System	33	22
Lower Costs of Production	24	16
Improve Soil Conditions	23	15
Commitment to Land Stewardship	17	11
Other	11	7

than a primary motivation.

7.2 Factor Selection

The subject of barriers to adoption was addressed in two ways. In one approach, respondents were asked direct questions regarding their reasons for using, or not using, conservation practices in their farm operation. The results will provide the basis for Section 8 of this report.

It was also possible to examine the existence of barriers to adoption, by identifying possible relationships between levels of conservation practice use and a range of independent measures or factors for which data have been assembled. The rationale for this type of analysis was established in Section 3. The independent variables selected for analysis represent a range of farm, farmer, and farm business characteristics which were thought to be logically associated with the use of conservation practices. They are listed

in Table 7.2. Most of the variables were taken from the data set and were introduced in Section 5. However, the nature of the analysis required that some variables be synthesized or modified to provide usable information.

While information was assembled for all farm types, cash cropping was found to dominate the sample (73 per cent). Other farm types did not occur in sufficient numbers to be included separately in the analysis. Instead these farm types were aggregated and compared against cash crop farms. With few exceptions, these farms were livestock-based operations and thus provided an interesting basis for comparison.

Similarly, it was necessary to aggregate information from the questionnaire relating to soil problems other than erosion. For purposes of the analysis, the selected measure was the existence (yes/no) of any non-erosional form of soil degradation regardless of type.

The erodibility variable represents an attempt to recognize the actual 'need' for conservation practices on farms. This new variable was generated from the available data using the principles of the Universal Soil Loss Equation, and a methodology developed by Shelton et al. (1984). Questionnaire data on slope, soil texture and cropping practices were combined with a rainfall factor in this procedure. The SAS statistical analysis program was used to generate a measure of potential annual soil loss for each farm. Unfortunately the low level of precision in the inputs to the equation dictated that the results should not be used as absolute measures of soil loss. Rather, they served as relative indicators of the potential erodibility of farms in the study area. This level of detail was quite appropriate in view of the objectives of this study. For analytical purposes, farms were grouped into three classes of erodibility (low, medium, high). For greater detail on the

TABLE 7.2: FACTORS ASSOCIATED WITH THE USE OF CONSERVATION PRACTICES

Farm Characteristics	Farmer Characteristics	Farm Business Characteristics
Farm Size	Age	Tenure
Farm Type	Education	Equity Level
Erodibility	Intergenerational Expectations	Off-Farm Income
Past Erosion	Membership in Farm Organizations	Gross Farm Sales
Other Forms of Soil Degradation	Perception of Soil Erosion as an Agricultural Issue	
	Water Quality Concern	

method of calculation Shelton et al. (1984) should be consulted.

7.3 Analysis

The fifteen independent variables were tested for association with the level of adoption of conservation practices by farmers. This analysis utilizes the conservation practices index which was developed in the previous section. In addition to identifying the potential influence on the level of practice use, each independent variable was also tested with the two key measures of conservation tillage and crop rotation. This latter step was undertaken to check for consistency between the index and specific practices, and to identify any influences which may be unique to the adoption of these important measures. The analysis utilizes the non-parametric chi-square and Kruskal-Wallis statistics to test for differences between groups.

7.3.1 Farm Characteristics

Level of practice adoption was found to be significantly associated with four of the five farm characteristics tested (Figure 7.1). Significant factors were farm size, farm type, past erosion and other forms of soil degradation.

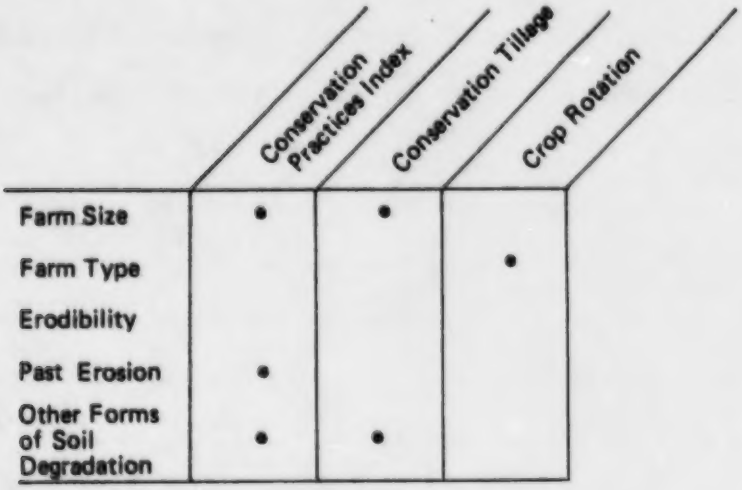
Farm Size

Farm size, was found to be a significant factor for both the practices index and the adoption of conservation tillage but was not related to crop rotation. It was apparent that practice use was greatest on larger farms, and lowest on smaller farms. Interestingly, average farm size declined with each level. Clearly, operators of larger farms tend to be more active adopters of conservation practices. The same trend was apparent in the adoption of conservation tillage with adopters operating farms which were significantly larger than non-adopters. In both cases this may represent a greater level of sophistication in the farm operation and/or the influence of economies of scale.

Farm Type

Farm type does not seem to be strongly related to adoption of conservation practices. Farm type was related to only one of the three measures of conservation involvement - crop rotation. The data suggest that higher than expected levels of adoption of this practice occurred on farms which were not classified as cash crop operations. As noted earlier, with the exception of sixteen fruit and vegetable farmers, these individuals operate livestock-based operations where, in many cases, forage and small grains in rotation represent a long standing element of the management system.

FIGURE 7.1: FARM CHARACTERISTICS ASSOCIATED WITH THE ADOPTION OF CONSERVATION PRACTICES



• Association significant at 95% confidence level.

Past Erosion

This information was used to check for a relationship between reported erosion and adoption. It is well accepted that perception of a problem represents a necessary first step for most farmers. A perception of past erosion was found to be significantly related to the level of practice use but not to specific practices. In general, high level adopters were more likely to have noticed erosion on their farms than were individuals positioned in lower level adopter groups. While it is tempting to speculate on the differing abilities of farmers to detect an erosion problem, it must be noted that some farmers who did not report any erosion will have correctly judged the conditions on their farm.

Other Forms of Soil Degradation

Conservation practices may be adopted for reasons other than the existence of a soil erosion problem. The reported existence of other forms of soil degradation was significantly related to both the level of practice adoption and the adoption of conservation tillage. In the case of the general index, the reporting of other soil problems was associated with higher levels of practice adoption. Similarly, farmers who had observed other soil degradation problems were more likely to have adopted a conservation tillage system than those who had not experienced these problems.

7.3.2 Farmer Characteristics

Of the six farmer characteristics included in the analysis, three were found to be significantly related to one or more of the dependent variables (Figure 7.2). The significant factors were age, membership in farm organizations and perception of the seriousness of soil erosion as an agricultural issue.

Age

Age was found to be significantly related to the conservation practices index but not to either conservation tillage or crop rotation individually. Generally the results agreed with the conventional notion that the greatest activity in the use of conservation practices is displayed by middle-aged farmers who are both well-established in their farming careers, and still anticipating a number of years in farming. These characteristics are thought to reflect both the ability and inclination to make investments in the farm business.

FIGURE 7.2: FARMER CHARACTERISTICS ASSOCIATED WITH THE ADOPTION OF CONSERVATION PRACTICES

	Conservation Practices Index	Conservation Tillage	Crop Rotation
Age	•		
Education			
Intergenerational Expectations			
Membership in Farm Organizations	•	•	•
Perception of Soil Erosion as an Agricultural Issue	•	•	
Water Quality Concern			

• Association significant at 95% confidence level.

Membership in Farm Organizations

Membership in farm organizations represents both a potential information source and an indicator of dynamism among farmers. Involvement in organizations was found to be significantly related to all three of the conservation practice variables. With regard to the conservation practices index, adopters in Levels 1 and 2 were more likely to be involved in farm organizations than were farmers in the two lower levels. In the case of the two individual practices, tillage and rotation, adopters were more actively involved in farm organizations than were non-adopters. Beyond the general speculative observation already ventured above, it was not possible to ascertain the reason for

this relationship.

Perception of Soil Erosion As An Agricultural Issue

As noted previously, farmers were offered a list containing a variety of agricultural issues, and asked to indicate those which they considered most important. The selection of soil erosion was taken to represent a high level of concern.

The identification of a soil erosion concern was related to both the level of practice use and the adoption of conservation tillage but not to crop rotation. Concern over soil erosion as an agricultural issue was associated with higher levels of adoption. While 56 per cent of Level 1 adopters indicated a concern over soil erosion, only 15 per cent of the members of the lowest adopter group shared this concern.

Adoption of conservation tillage was also significantly related to concern over soil erosion generally. Those with this concern were nearly twice as likely to have adopted conservation tillage practices as other farmers. It would be interesting to learn whether concern over erosion preceded adoption or was a consequence of involvement in a conservation effort. Unfortunately such a conclusion was not possible from existing data.

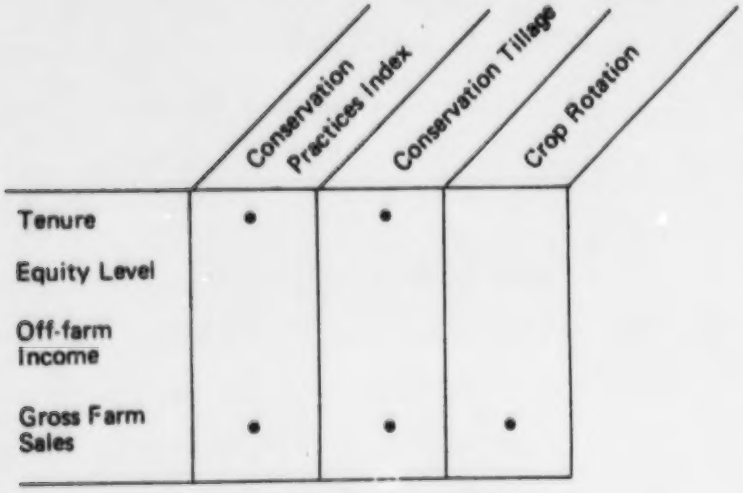
7.3.3 Farm Business Characteristics

Four economic or financial factors were tested against each of the three dependent variables. Two were found to be significant. These were tenure and gross farm sales (Figure 7.3).

Tenure

Tenure represents a much studied factor in adoption research. Results are often contradictory. While some studies have suggested that increasing land rental is not related to land management practices, most studies hypothesize

FIGURE 7.3: FARM BUSINESS CHARACTERISTICS ASSOCIATED WITH THE ADOPTION OF CONSERVATION PRACTICES



• Association significant at 95% confidence level.

that tenants are less likely to invest in conservation practices because of either lack of commitment to the soil resource or a lack of assurance that they will be able to retain the same parcel of rented land.

Tenure was found to be related to both the conservation practices index and the adoption of conservation tillage. Specifically, increasing amounts of rented land were related to a higher level conservation practice use. The same was true for those farmers with a high proportion of rented land (although these were few in number). Similarly in the case of conservation tillage, adoption was related to increasing amounts (and proportions) of rented land. This result is difficult to interpret with certainty, but it is strongly suspected that this independent variable is related to the effect of farm size and that its significance for adoption rates is actually a function of the scale of farm operation as reflected in acres farmed.

Gross Farm Sales

Higher levels of farm sales are generally hypothesized to be associated with conservation practice adoption because they provide greater levels of discretionary investment income. Farm sales were found to be related to all three of the dependent variables in this analysis.

Within the four groupings of conservation practice use, high levels of farm sales were associated with higher levels of conservation practice adoption. While over 60 per cent of Level 1 farmers reported gross annual sales in excess of $100,000, more than 70 per cent of Level 4 farmers fell below $50,000 in sales. Both intermediate levels of adopters fell between these extremes.

In the case of both conservation tillage and crop rotation a similar pattern emerged. Nearly 60 per cent of tillage adopters reported income in excess of $100,000 while over 60 per cent of non-adopters fell below this level of sales. Results for crop rotation were comparable although it should be noted that rotation was more widely adopted than conservation tillage.

These results strongly indicate that the adoption of conservation practices is influenced by increased levels of sales. As mentioned above, these sales are thought to reflect a greater opportunity to invest in the farm operation.

7.4 Summary

This analysis tested a number of independent variables related to the physical, human and economic characteristics of the farm operation. Significant influences on the adoption of conservation practices were scale of farm operations (as reflected in both farm size and gross sales), perceptions of erosion and other soil problems, age of the farm operator, membership in farm organizations, concern over erosion as an agricultural issue and tenure/land rental. Unfortunately, due to the non-parametric nature of the data, it was

not possible to ascertain the amount of variation in conservation practice attributable to each factor.

It is interesting to note that factors related to the adoption of a forage or small grain-based crop rotation were related to farm type, membership in farm organizations (most often producers' associations) and gross farm sales, and not to any conservation-related variables. This suggests that crop rotation, and possibly other practices, are not adopted for conservation purposes, but are influenced by farm structure and type factors.

This exercise also highlighted a number of potential barriers to adoption. These almost certainly include lack of land, lack of investment capital, and age (at either extreme), and may include inability to recognize soil problems, lack of awareness of solutions, and lack of conservation concern.

8 BARRIERS TO ADOPTION

Section 7 identified a number of factors that appear to be related to the adoption of conservation practices. From these it is possible to speculate on potential barriers to adoption. This section of the report takes a direct approach to the subject of barriers to adoption by exploring the attitudes of farmers toward conservation practices. The section will address both perceived barriers to adoption, and the prospects for overcoming these barriers to enhance rates of conservation practice use.

8.1 Obstacles Overcome by Adopters

Farmers who currently use conservation practices were asked to provide responses to an open-ended question regarding the difficulties that they had overcome before they were able to adopt these practices. This approach was considered preferable to forcing respondents into pre-selected response options. Unfortunately, the open-ended format did not consistently yield sufficient information to classify respondents. These deficiencies were addressed during telephone interviews, in which respondents were prompted to expand upon the types of obstacles which they had overcome.

While individual responses were often specific to the farm operation, they could in most cases, be grouped by basic response types (Table 8.1). Interestingly, the most frequently provided response was that there had been no significant obstacles to overcome. While this may appear surprising at first, recall that in the last section it was reported that 22 per cent of conservation practice users adopted practices because they were a basic or integral component of the farm business (Table 7.1). Under these circumstances it is logical that many farmers would implement certain practices as a matter of course. Also, these individuals were most often operators of livestock-based farms who

TABLE 8.1: OBSTACLES OVERCOME BY ADOPTERS

Obstacle	No.	% of Respondents
No Obstacles	49	37
Complexity of Practices	37	28
Start-up Costs	36	27
Lack of Technical Assistance	20	15
Hard to Change	15	11
Slow Return on Investment	13	10
Other	7	5

Note: N = 134.

Respondents may note more than one obstacle.

were accounting for their use of forage in rotation as well as other cropping-related practices. In other words, some practices, while offering incidental conservation benefits, are not used for their conservation values.

The obstacle most frequently reported by adopters was the complexity of conservation practices. Nearly 30 per cent of adopters suggested that a conservation farming system represented a more difficult system to manage because the adoption of one measure (e.g., tillage) frequently necessitated substantial changes to other aspects of the management system (e.g., weed and pest control). Similarly, many farmers in this group suggested that complexity in implementation rose from the need to modify or adapt conservation practices to their farm conditions. Not all practices were seen as universally applicable or needed.

Another frequently reported obstacle for users of conservation practices was associated start-up costs. Twenty-seven per cent of respondents indicated that they had experienced difficulty finding the capital for investment in conservation practices. In many cases, these farmers were referring to equipment costs associated with a conservation tillage system, but some noted the high costs of land drainage, windbreak stock, and structural erosion control measures as major obstacles.

Among other significant obstacles which had confronted adopters were difficulties in obtaining technical information, a perceived slow return on conservation investments, and reluctance to make changes to a successful management system. In view of the need to modify and adapt conservation practices, farmers indicated that they required on-site technical assistance before they were able to implement practices on their farm properly. Reported sources of this assistance were OMAF advisors, implement dealers and neighbours. Slow return on investments in conservation represented another economic barrier to adoption. Several farmers indicated that, with little financial flexibility, it was difficult to include conservation expenditures in yearly budgeting, especially when other investments such as land provided an immediate return.

Finally, a significant number of adopters indicated that they had simply found it difficult to recognize, and become convinced of, the need to make changes. Farmers in this group acknowledged the effect of inertia or the natural tendency to observe the status quo. Interestingly, this rather logical obstacle to conservation practice adoption seems to be either overlooked in the literature, or attributed to age and experience.

Other responses provided did not occur in sufficient numbers to warrant the creation of separate categories. They included lack of opportunities for

experimentation, lack of land, and unwillingness of lending institutions to finance investments in conservation.

8.2 Reasons for Non-Adoption

Farmers who had not adopted conservation practices on their farms were asked for an explanation. In some cases respondents had not adopted any practices, but most often these individuals described the reasons or barriers which prevented them from adopting more practices than they currently used. Again, the responses were sought in an open-ended format and clarified during telephone interviews. The major barriers to adoption are listed in Table 8.2.

Among the most commonly stated reasons for not adopting was a perceived inadequacy in the technology, or in some cases a perceived unavailability of appropriate technology. Respondents complained of difficulties with weed control in conservation tillage systems, the lack of viable reduced tillage systems on fine-textured soils, the apparent contradiction of recommended manure incorporation while minimizing tillage, and fears of reduced yield in conservation tillage systems.

Also frequently noted was the belief that, in many cases, conservation practices were either not needed, or not worth the cost. With respect to 'need', it was found that this observation was often made by farmers who had not reported the existence of erosion on their farm. Unfortunately, it was not known whether these individuals actually did not need conservation practices or whether they simply failed to recognize the need.

With respect to the 'worth' of practices, this obstacle would seem related to the slow return on investment, noted by adopters. While some farmers favour conservation practices in principle, they report that they do not appear to be cost effective and are rejected for this reason.

TABLE 8.2: REASONS FOR NON-ADOPTION

Reason	No.	% of Respondents
Perceived Inadequacy of Technology	18	30
Not Perceived as 'Worth the Cost'	17	28
Initial Investment	13	22
Not Compatible with Existing Practices	12	20
Struggling for Economic Survival	8	13
Not Able to Participate in Government Program	8	13
Other	8	13
No Use for Forage	5	8

Note: N = 60.

Respondents may have indicated more than one barrier.

Financial barriers to adoption were reported by over 20 per cent of respondents to the question regarding reasons for non-adoption. The inability to absorb costs associated with conservation practices related to two basic factors. The first was the lack of discretionary income for investment in conservation practices because of high debt. This lack of flexibility suggests that some farmers are involuntarily tied to their existing management system. Second, farmers indicated that they were unable to invest in conservation practices because of the size of the farm operation. For example, some

operators of smaller farms suggested that they were constrained in their investment alternatives because of the scale of the farming operation. This agrees well with findings relating to farm size in the last section.

As discussed earlier in this report, conservation technologies are often regarded as system rather than item innovations. This characteristic of conservation practices was identified as a barrier to adoption by 20 per cent of respondents. These individuals indicated that some conservation practices (primarily tillage and rotation) were not compatible with existing practices and required a major change to the current management system. While some farmers may be interested in specific conservation practices, they may be deterred from taking action because of the implications for other aspects of their operation.

Two other reasons for non-adoption reported by respondents were, the need to maximize short-run profit as a survival strategy, and the lack of opportunity to participate in a government program. The necessity of short-run production maximization is a fact of life for many farmers who continue to struggle for economic survival and must adopt a management system that generates maximum short-run returns. Under these conditions, investment in conservation practices which yield a monetary dividend in the long term (if at all) is unlikely. Secondly, some respondents with an interest in conservation practices, expressed frustration at not being able to participate in government initiatives such as the Ontario Land Stewardship Program or the conservation services programs of various conservation authorities. These farmers, who regard program support as a necessary condition to adoption, found that demand for available human and financial program resources exceeded supply. Other interesting reasons for non-adoption were provided by selected respondents. These included age (a

shortened planning horizon), habitual behaviour, and uncertainty regarding the types of conservation practices needed.

The responses provided by both adopters and non-adopters in this section identified a range of barriers to the adoption of conservation practices. In general terms, these barriers relate to financial, technical, farm structure, institutional, and human factors which constrain many farmers from adopting conservation practices. The remainder of this section examines the prospects for overcoming these barriers and enhancing the adoption of conservation practices by farmers.

8.3 Prospects for Overcoming Barriers

In order to increase the adoption of conservation practices it is necessary both to identify blockages to adoption, and to ascertain the means by which these barriers might be overcome. However, the removal of impediments will only increase adoption if there exists a basic interest, among farmers, in using conservation practices.

Respondents were asked if they were interested in adding some (or more) conservation practices to their management system. It is encouraging that nearly two-thirds of all participating farmers indicated that they were interested in beginning or increasing their conservation effort. This figure is somewhat higher than that reported in recent research for Ontario (for example, Wall et al., 1985). Consequently, interest does not appear to be the limiting factor in farmers' decisions regarding conservation practices.

8.3.1 Conditions Required for Adoption

Respondents were asked, in open-ended fashion, for the conditions or actions which would make it possible for them to use conservation practices not currently employed. While it would have been possible to speculate on

necessary conditions and provide response options, farmers' spontaneous responses to this question were preferred. Answers were placed in broad categories which were thought to capture the essence of the responses (Table 8.3).

The most frequently-noted condition for adoption was proof that recommended technologies were efficient and cost-effective. Many farmers indicated that selected conservation practices, most notably reduced tillage, were not used because they were not well-suited to their farm. Major concerns related to weed control, manure management, and the expectation of decreased yield. Both written and verbal responses indicate that the most serious of these was the concern relating to yield reduction with the use of reduced tillage systems on fine-textured soils.

Farmers also observed that higher product prices would enable them to begin or increase their conservation effort. Many respondents indicated a high level of frustration over the lack of profitability (perceived or real) in farming. Higher prices for farm products were desired for three basic reasons. Some farmers indicated that higher prices would enable them to ease the intensity of their farming operation and remove erodible land from production. Others stated that higher profit margins would increase discretionary income and facilitate investments in conservation practices. Finally, producers indicated that better (some) profits associated with farming would provide a sense of stability regarding their future in agriculture, thereby encouraging investment in 'long-term' measures. It should be noted that evidence in the United States suggests that, in some cases, higher profit margins have actually served to intensify farming operations.

TABLE 8.3: CONDITIONS NECESSARY FOR ADOPTION

Condition	No.	% of Respondents
Proof of Efficiency and Cost Effectiveness	50	34
Higher Product Prices	47	32
Financial Incentives	43	30
Technical Assistance	27	18
Proof of Need	23	16
Availability of Rental Equipment	23	16
Other	16	11
Guaranteed Income During Experimentation	9	5

Note: N = 176.

Financial incentives in the form of grants, cost-sharing programs, and tax benefits for conservation, were identified as conditions which would enable 30 per cent of respondents to begin or increase their use of conservation practices. For these individuals the economic merits of the practices were not perceived as sufficient to initiate adoption. They suggested that financial incentives would increase the attractiveness of certain measures, and in some cases, would help overcome constraints associated with a lack of investment income. Again, many farmers expressed disappointment over not being able to participate in OMAF's Land Stewardship Program. With respect to the two economic conditions just mentioned - higher product prices and financial

incentives - it is interesting that several producers acknowledged that only higher product prices would promote a continuing conservation effort by farmers.

A significant number of farmers suggested that they required on-site technical assistance before they would proceed with conservation practices. Some members of this group indicated that although they were aware of their soil problems, and of some of the conservation measures available, they were unsure as to which practices were needed on their farms. This condition related to another frequently mentioned requirement for adoption - proof that soil conservation practices were needed. Sixteen per cent of respondents indicated that they would not be prepared to adopt additional conservation practices unless proof of their need was provided on-site. The solution to both of these requirements would appear to be increased numbers of trained extension personnel. The prospects for this will be discussed in Section 9.

The last commonly-noted condition to adoption was the need for opportunities to rent conservation equipment (primarily tillage and planting). Two basic reasons were given for this requirement. First, farmers indicated that they were not prepared to adopt expensive modifications to their management system without sufficient opportunities for experimentation. These opportunities were most often obtained through rental trials with implement dealers or conservation authorities. Second, some farmers indicated that, given the small size of their farm operation they would be unable to purchase conservation tillage and planting equipment, but would be prepared to utilize these methods if rental equipment (or custom work) were available on an on-going basis (as an alternative to acquisition).

A range of other conditions to adoption were provided by respondents. However, those reported above capture the salient conditions or actions which

respondents suggest are required for adoption. Other conditions provided by respondents included the availability of land, the ability to utilize existing equipment, and the need to implement practices because of regulatory or legislated approaches. A small number of respondents indicated that they were unwilling to change their management system under any circumstances.

8.4 Summary

This section has identified a range of barriers to adoption, and outlined findings relating to the conditions necessary for their removal. Information was presented from both those who had overcome difficulties to use practices, and from those who were currently constrained from beginning or increasing their conservation effort. It is noteworthy that few of the identified barriers, or adoption requirements related to attitudes toward conservation or awareness of the existence of practices. Where information was noted as a deficiency, this need related to a request for detailed, on-site technical proof of both the need and the applicability of various conservation practices.

As noted earlier, key barriers to adoption appear to relate to economic conditions in farming and the technical characteristics of many practices. Farmers have suggested that removal of these barriers would enable them to increase levels of adoption. The final section of this report briefly examines the implications of these findings, for soil conservation policies and programs in Ontario.

9 POLICY IMPLICATIONS AND CONCLUSIONS

9.1 Policy and Program Options

While it has long been recognized that land-use regulation through the planning process is a necessary and acceptable means of protecting the quantity of agricultural land in Ontario, management of the quality of agricultural land is a different matter. Throughout North America, public policy in the field of soil conservation has been designed to facilitate the voluntary compliance of farmers (Swanson et al., 1986). Education, demonstration and cost sharing have been the staples of public intervention in both Canada and the United States. These programs have traditionally focussed on the role of information, technical assistance, and financial support in promoting soil conservation.

Because most soil conservation programs rely on voluntary participation, farmers must be convinced that recommended practices offer some benefit (however measured) before they can be expected to act. Research in Ontario (for example, Fox and Dickson, 1988; Stonehouse et al., 1987) has suggested that farmers who adopt conservation cropping and tillage systems may be financially disadvantaged in the short run (and perhaps the long run as well). Despite this, considerable adoption has occurred. This suggests that many farmers are motivated by factors other than short-run profit maximization in their decisions regarding conservation practices. These factors include concern over the sustainability of the soil resource and ethical or moral commitments to land stewardship.

It is now recognized that the impacts of soil erosion and other forms of degradation are felt both on and off the farm (Clark et al., 1985). While the on-site consequences of erosion, such as reduced yield or increased costs of production, provide clear motivation for farmers to implement soil conservation

practices, off-farm costs are externalised to society and thus provide a much weaker impetus for adoption.

In recognition of the societal interest in both food sufficiency, and environmental quality, public agencies are committed to widespread adoption of conservation practices by farmers. As noted above, conventional policy and program responses have relied on the role of education, information and incentives. Increasingly however, alternative measures have been proposed and/or implemented in other jurisdictions. These include:

1. cross compliance - the linking of eligibility for various agricultural subsidies and benefits to participation in soil conservation programs,
2. legislation - the establishment of soil loss limits and enforcement of minimum land management standards,
3. financial incentives - cost sharing programs, low interest loans, tax deductions for conservation investments,
4. education - demonstrations, promotional efforts, technical assistance,
5. production quotas - maximum limits on production to reduce 'degrading land-management practices',
6. penalties - soil loss taxes or fines (i.e., the imposition of financial disincentives), and
7. targeting - the direction or focus of resources to areas of greatest need and potential.

These measures represent only some of those possible, but illustrate that many soil conservation policy options are philosophically and operationally quite different.

Participants in the survey were presented with a list of policy and program options, similar to those identified above. Farmers were asked to

select the option which they a) most preferred and b) believed to be the most effective means of increasing the use of conservation practices (Table 9.1). The purpose of the exercise was to check for possible differences between farmers' perceptions of policy popularity versus policy effectiveness. Other studies have found significant differences between the measures that farmers favour and those they rate as most likely to achieve desired goals (Swanson et al., 1986; Christensen and Norris, 1983).

The results in Table 9.1 suggest both the popularity and perceived effectiveness of financial incentives and tax deductions as means of promoting soil conservation to farmers. Conversely, regulation or the control of land-use and farming practices, was least preferred and was felt to be least effective. Education programs and the provision of on-site technical assistance were also thought to be efficient means of increasing the use of conservation practices on farms.

It is interesting to note that the data exhibit little variation between most preferred and most effective measures. While respondents may simply favour those measures which they believe to be most effective, it is suggested that these results might well have been influenced by the method of data collection. The mail questionnaire may not have provided a suitable vehicle for introducing, and collecting responses to, innovative, unfamiliar, and in some cases, potentially threatening policy and program alternatives.

While respondents as a group generally favoured existing policy approaches, an attempt was made to examine possible relationships between policy perceptions and the level of conservation practice use (as measured by the conservation practices index in Section 7). The analysis grouped policy alternatives into four broad catagories - education, technical assistance, financial supports,

TABLE 9.1: POLICY ALTERNATIVES

Measure	Most Effective (%)	Most Favoured (%)
Financial Incentives	40	30
Tax Deductions	18	18
Education	11	13
On-Site Technical Assistance	10	17
Penalties	7	3
Cross Compliance	6	10
Targeting	5	7
Soil Loss Regulation	3	2

Note: N = 161.

and regulatory measures. These alternatives were compared to the conservation practices index. The results indicated that there was no apparent relationship between level or intensity of conservation practice use, and preferences or perceived effectiveness relating to soil conservation policies and programs. Clearly, both adopters and potential adopters share similar attitudes toward acceptable forms of government intervention in the promotion of soil conservation practices and technologies.

9.2 Policy Implications

This study has identified a range of barriers to the use of soil conservation practices in farming, and has examined the prospects for increasing their adoption. These findings have important implications for soil conservation programs and policies.

As noted earlier, soil conservation initiatives in both Canada and the United States have traditionally relied on information, education and financial incentives to obtain the voluntary compliance of farmers in practising soil

conservation. The findings of this research have suggested that farmers in the study area are generally aware of the existence of soil and water degradation, are familiar with at least some of the recommended soil conservation technologies and practices, and are very receptive to, and supportive of, financial incentives. In spite of this apparent pre-disposition toward adoption, several barriers currently impede the increased use of soil conservation practices. The policy-related implications of these barriers, and the reported means necessary for their removal, are briefly discussed below.

Education and information, despite its emphasis in current and past programs, is still required by farmers. However, the findings of the study suggest that the types of information required by farmers vary widely. They include not only evidence of the societal need for soil and water conservation, but more importantly, include detailed technical information on a) exact measures or practices required, b) best methods of implementation, and c) anticipated costs and benefits of practices in both the short and long term. This suggests the potentially significant contributions of increased extension and applied research on soil conservation technologies.

The provision of financial assistance was thought to be the most effective means of government involvement in soil conservation, by 58 per cent of respondents. However, only 22 per cent of the same group indicated that initial start-up or investment costs were the factor which prevented them from beginning or increasing their conservation effort. This discrepancy may suggest that financial incentives, despite their apparent popularity with farmers, are not sufficient to ensure the widespread adoption of conservation practices. Indeed, several respondents observed that, given the perceived temporary and limited supply of grants and cost-sharing opportunities, the

economic condition which would most increase adoption is higher profits in farming. However, as discussed earlier, research in the United States indicates that soil conservation measures are most often adopted for economic rather than environmental reasons (Christensen and Norris, 1983; Pampel and Van Es, 1977). This may suggest that, in some cases, an increased conservation effort would occur only if it generated increased revenues. These views underscore the importance of technological and managerial advancements rather than the value of financial assistance.

The regulation or legislation of soil and water conservation was not a popular option among survey respondents. Farmers clearly prefer a voluntary approach to soil conservation. However, as Crosson (1984) observes, voluntarism works best when the main objective of policy is to protect soil fertility. Results reported earlier indicated that 62 per cent of farmers who had adopted soil conservation practices, had done so to protect the long-term productivity of their soil. In comparison, relatively few adopters (11 per cent) noted a basic interest in land stewardship and environmental protection as their reason for adoption. The implications of this for soil conservation policies are far-reaching. Continued reliance on voluntary compliance requires the development of conservation technologies and systems which are profitable and readily implementable before many farmers will act. If environmental quality objectives increase the required level of soil conservation beyond that needed to ensure continued productivity, then it may be necessary to contemplate alternative policy and program measures.

The results of the study showed that farmers differed greatly in terms of reported barriers to adoption. Some respondents indicated that recommended practices were not appropriate for their soil type or management system.

Others indicated that financial constraints prevented their involvement in soil conservation, or that they were unconvinced of the need for - or value of - conservation practices. These biophysical, economic and human differences suggest the need for both variety in soil conservation programs, and for the targeting of programs to appropriate areas and groups (Duff et al., 1988). Clearly, needs exist for all of the program initiatives currently in place in Ontario, however appropriate targeting of resources may enhance the effectiveness and efficiency of each.

9.3 Summary and Conclusions

This research has examined the nature of conservation practice use in Southwestern Ontario, identified influences on conservation decision making, reported perceived barriers to adoption, and discussed prospects for improving technology transfer. It was found that most farmers in the study area presently use some conservation practices on their farms, and that variation occurs primarily in the intensity of conservation effort.[1]

Revealed barriers to adoption included the scale of farm operations, the nature of the farm business, and the perception and interests of farmers regarding soil degradation. Barriers reported by farmers related primarily to economic constraints, perceived technological deficiencies, farm structure limitations, and lack of institutional supports.

One of the major research interests of this project was to examine the prospects for improving or increasing the adoption of conservation technologies

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[1] Conservation effort has been measured by number and type of practices only, and not by the area over which practices have been applied. Inclusion of the latter would strengthen the measurement but was not possible given the level of detail at which data were collected.

by farmers. Interestingly, the most often cited condition required to facilitate adoption was proof of the efficiency and cost effectiveness of conservation practices. As noted earlier, in policy systems rooted in voluntary compliance, farmers must be convinced of both the need for and practicality of conservation practices before they can be expected to act.

Other facilitating conditions related to increasing the ability of farmers to invest in conservation practices (through increases in farm income or the provision of financial assistance) and improving their ability to implement practices properly (through technical assistance and increased opportunities for experimentation).

The research confirmed that farmers respond most favorably to policy and program initiatives which feature assistance and education rather than legislation and regulation. Existing approaches are not only voluntary, but also equitable in that farmers select themselves for participation based on their level of interest in soil conservation. This may or may not ensure that significant problem areas are treated. It is noteworthy that the independent measure of potential erodibility used in this study was not significantly related to adoption.

If the objective of public policy is efficiency and effectiveness in the reduction of soil erosion and phosphorus loading from agriculture, then it may be necessary to examine the effectiveness of traditionally 'passive' approaches to public intervention. The merits of targeted responses to soil and water degradation, based on severity of conditions, are suggested by the findings of this research. Selective and pro-active measures, both financial and technical, along with the continued development and refinement of technology may be required to achieve current soil conservation objectives.

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APPENDIX A: LETTER OF INTRODUCTION

UNIVERSITY of GUELPH

COLLEGE OF SOCIAL SCIENCE
Department of Geography

August 2, 1988

Dear

In May 1986, a federal-provincial agreement was announced to improve soil and water quality in Southwestern Ontario. The five year Soil and Water Environmental Enhancement Program (SWEEP) has been developed to advance soil conservation through the provision of technical and financial assistance to farmers. In order to provide this assistance there is a need to understand the farmer's perspective on soil conservation.

To gain this knowledge we are conducting a study of farmer's reasons for using or not using conservation practices in their farming operations. The study also explores the ways in which government can provide the most beneficial programs for farmers interested in soil conservation. The project is undertaken by the Department of Geography at the University of Guelph and by Agriculture Canada.

Agricultural research is often conducted by universities or goverment departments without the direct involvement of farmers. In this case we are seeking the direct input of farm operators. Policies and programs which are devised to assist you should have the benefit of your participation in their early stages. Your involvement in this study will improve the quality and value of its findings.

Our research involves the collection of data through the use of a questionnaire which will be mailed to you shortly. Since this is a busy time of year for you, the questionnaire has been made as brief and straightforward as possible - it shouldn't take more than half an hour to complete. While the success of our study hinges on the input of practicing farmers, your participation is entirely voluntary. If you are unable or unwilling to participate, please advise me (extension 6788), and your name will be removed from our mailing list. We look forward to, and appreciate your contribution to our study.

Yours sincerely,

John Smithers

Cette questionnaire est disponible en francais pour ceux qui le désirent. Veuillez communiquer avec la personne indiqué ci-haut.

GUELPH • ONTARIO • CANADA • N1G 2W1 • (519) 824-4120

APPENDIX B: QUESTIONNAIRE

CONSERVATION PRACTICES STUDY

INTRODUCTION (please read)

In recent years, both the farming and non-farming communities have recognized the need to protect Ontario's agricultural lands and waters through the prevention of soil erosion. Recent research has revealed that excessive soil erosion threatens the prosperity of many farming operations and can damage the environment.

Various conservation practices are being developed and recommended to farmers. In many cases it is the farmer who is developing these new methods and practices. As explained in the letter you received earlier, the purpose of this research project is to examine the benefits and problems associated with the use of conservation practices in farming. Much research is done entirely by academics or government, yet greatly involves and affects farmers. Our objective is to get major input into this research project from practicing farmers themselves thereby ensuring that our results are valid and useful.

As promised, the questionnaire has been kept as brief and straightforward as possible. **It is important that it be filled out by the principal manager of the farming business.** The data collected in this study will be analyzed and reported as averages and trends for groups of respondents. **Your individual responses will not be reported by the University of Guelph in any way.*** When you've finished the questionnaire please use the enclosed business reply envelope and return it as soon as you can manage **(before September 12 please).** In the mean time, if you have any questions or comments please don't hesitate to contact me at the address or telephone number given below. Many thanks.

John Smithers
Department of Geography
University of Guelph
Guelph, Ontario
NIG 2WI
(Telephone: 824-4120 ext. 6788)

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* With respect to Agriculture Canada, personal information will be stored in Personal Information Bank DOA/P-PU-275 and will be protected under the provisions of the Privacy Act. Other information may be accessible or protected as required under the provisions of the Access to Information Act. Government Collection Registration Number DOA/ADB-495-02901.

CONSERVATION PRACTICES QUESTIONNAIRE

PART A

1. In your opinion, what are the most pressing issues facing farmers in Southwestern Ontario? (Check one or more).

Availability of credit	____
Free trade	____
Soil erosion	____
Farm product prices	____
Urban expansion	____
Interest rates	____
Water pollution	____
Climate change	____
Declining interest in farming among young people	____

Add anything else you feel strongly about. _____

_____

_____

_____

_____

2. Briefly, what would you like to see government do in view of the problems facing agriculture and the environment?

_____

_____

_____

_____

3. What do you see as the main cause of increased soil erosion and water pollution in Southwestern Ontario?

_____

_____

_____

_____

Farm Characteristics

The remainder of this section deals with general characteristics of your farming business.

4. How many acres do you farm? _____ acres
   - how many of these acres do you own? _____ acres
   - how many acres do you rent from others? _____ acres

5. What crops are grown on the land you farm in 1988? (Crop type and number of acres please).

Crop type	Acres
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

6. Does this use of your land represent a significant change from 5 years ago?

   YES _____; NO _____; If YES, briefly note the main changes.

   _____

   _____

   _____

7. What is your major enterprise? (Check one or more).

Beef	_____	Cash crop	_____
Dairy	_____	Fruit or vegetables	_____
Swine	_____	Tobacco	_____
Poultry	_____	Mixed (what type?)	_____
Sheep	_____		_____
		Other (specify)	_____
			_____

8. If you are engaged in both livestock and cash crop farming, what percentage of your total sales would you roughly say come from each? (For example 60% cattle - 40% corn, etc.).

   _____

The next few questions deal with the soil texture and slope of your farm (if you are operating several farms please deal with the one you consider to be your main farm).

9. Where is your farm located?

   Lot _____; Concession _____; Township of _____

10. Roughly, how much of your land falls into the following soil texture catagories?

Coarse (sandy)	_____ acres
Medium (silt loam)	_____ acres
Fine (clay loam)	_____ acres
Organic (peat or muck)	_____ acres

11. Would you describe your farm as generally: (Check one).

Flat land (less than 2% slope)	_____
Rolling land (2% to 7% slope)	_____
Steeply sloped (greater than 7% slope)	_____

12. Is soil erosion a problem in your **township**?

    YES _____; **NO** _____; **DON'T KNOW** _____

13. Do you believe any of your **neighbours** have a soil erosion problem?

    YES _____; **NO** _____; **DON'T KNOW** _____

14. Have you observed evidence of soil erosion on **your own farm**?

    YES _____; **NO** _____; **DON'T KNOW** _____

    (If NO, then skip to question 18)

15. If you have experienced erosion on your farm, was it:

Water erosion	_____
Wind erosion	_____
Both types	_____

16. If you have experienced erosion on your farm, how severe was it?

Very severe	_____
Severe	_____
Moderate	_____
Minor	_____

17. Do you believe your soil productivity has been reduced because of erosion? (This may be reflected in either reduced yield or higher fertilizer requirements).

YES _____; NO _____; DON'T KNOW _____

18. Do you have any of these other forms of soil degradation on your farm?

Soil compaction:	YES _____;	NO _____;	DON'T KNOW _____
Poorer soil structure:	YES _____;	NO _____;	DON'T KNOW _____
Loss of water holding capacity:	YES _____;	NO _____;	DON'T KNOW _____
Loss of organic matter:	YES _____;	NO _____;	DON'T KNOW _____
Loss of fertility:	YES _____;	NO _____;	DON'T KNOW _____

PART B

Management practices

This section examines the cropping, tillage and land management practices used on your farm.

For the purposes of this survey we are dealing with those conservation practices which are generally held to be most promising and practical in Southern Ontario. These include:

- Conservation tillage (chisel plough, soil saver, ridge till, etc.)
- Increasing residue (trash) with modified moldboard plough
- Reduced secondary tillage
- Use of a forage based crop rotation
- Rotations which include a cereal grain
- Underseeding or cover crop
- Buffer strips
- Tile outlet protection
- Grassed waterways
- Drop inlets
- Windbreaks
- Fertilizer & Manure management (secure storage, rapid incorporation, etc)

The following questions relate to your familiarity with these methods of erosion control, and your judgement on their value to your farm.

1. Before being contacted about participating in this survey, were you aware of these practices as methods of soil conservation?

   YES _____; NO _____

2. If you were previously aware of the existence of some of these practices, where did you first learn of them?

OMAF agricultural rep.	_____
Conservation Authority	_____
Agricultural College	_____
Soil and Crop Improvement Association	_____
News media (farm papers etc.)	_____
Neighbours	_____
Farm Machinery Dealers	_____
Other (please specify)	_____

3. Which of the groups listed above have been most useful in providing information about conservation practices and technology?

_____

_____

4. Do you **use** any of the following conservation practices? (Please check off the ones you use under the appropriate heading below).

   (If you don't use any of these, then skip to question 8)

	Always used	Only in last 5 yrs
Conservation tillage (chisel plough, soil saver, ridge till, etc.)	_____	_____
Reduced tillage with moldboard plough	_____	_____
Crop rotation which includes hay or small grain	_____	_____
Cover crop	_____	_____
Plowdown crop	_____	_____
Buffer strips	_____	_____
Grassed waterway	_____	_____
Windbreaks	_____	_____
Drop inlets	_____	_____
Tile outlet protection	_____	_____
Others -including methods of manure/ fertilizer management (please specify)	_____	_____

_____

_____

5. What made you decide to adopt these practices on your farm?

_____

_____

_____

_____

6. What obstacles or difficulties did you have to overcome before you were able to incorporate the conservation measures you now use?

_____

_____

_____

_____

7. Are you interested in adding additional conservation practices to your management system?

YES _____; **NO** _____; **DON'T KNOW** _____

8. If you **do not use** conservation practices on your farm, please tell us your reasons for not using them.

(If you do use them, then skip to Question 10)

_____

_____

_____

_____

_____

9. Are you interested in using conservation practices on your land?

YES _____; **NO** _____; **DON'T KNOW** _____

To be answered by all respondents.

10. What conditions or actions would make it possible for you to use conservation practices which you currently do not use?

_____

_____

_____

_____

_____

11. If you are using any practice that you feel is helping protect your soil, and it has not yet been mentioned in this survey, please tell us about it in the space provided below.

_____

_____

_____

_____

_____

PART C

General Information

This final section will ask some questions about your background as a farmer, and your farming business.

1. Which of the following age groups do you fit into?

Under 20	____
20 - 30	____
31 - 40	____
41 - 50	____
51 - 60	____
61 - 70	____
Over 70	____

2. Which of these did you last attend? (Check one).

No Formal Schooling	____
Elementary School	____
High School	____
Agricultural College	____
Community College	____
University	____

3. How many years have you been a farmer? _____

4. Do you belong to any farm organizations?

YES _____; **NO** _____; If **YES**, which ones?

_____

5. Would you like a member of your family to take over your farm someday?

YES _____; **NO** _____; **DON'T KNOW** _____

The next three questions are intended to help us understand some economic factors which influence the types of decisions that farmers must make on a regular basis. You will notice that they are very general and ask for only broad estimates.

6. What percentage of your farming operation do you own as compared to that which is financed (in other words, your equity level)? (**Check one**).

Own less than 25%	____
Own between 25% and 50%	____
Own between 50% and 75%	____
Own over 75%	____

7. What percentage of your total household income would you say is obtained from working off the farm? (**Check one**).

Less than 10%	____
10% to 25%	____
25% to 50%	____
50% to 75%	____
More than 75%	____

8. We need to classify farms into size catagories according to **gross sales last year**. Please indicate the category into which your farming business fits by checking off one of the following:

Less than $25,000	_____
$25,000 to $50,000	_____
$51,000 to $100,000	_____
$101,000 to $150,000	_____
$151,000 to $200,000	_____
Over $200,000	_____

9. The following is a list of actions that governments could consider in order to promote conservation practices in farming:

A. Education programs
B. On site technical information (farm plans, etc.)
C. Financial incentives and supports
D. Direct control over land if erosion is excessive
E. Penalties (fines) if erosion is not controlled
F. Making eligibility for other agricultural subsidies depend on using conservation practices
G. Tax deductions for using conservation practices
H. Devote existing funding for assistance entirely to farmers with serious erosion problems

a) From this list, which option do you feel would be the most **effective** way of increasing the use of conservation practices in farming? (Give the letter). _____

b) From the same list, which option do you **favour** personally? (Again, just give the letter). _____

10. What other actions might government consider? _____

_____

_____

OTHER COMMENTS

a) If you have any additional comments about this questionnaire or the issue of soil and water conservation generally, please feel free to state them below or on the back of the page.

_____

_____

b) In order to complete this study, it is possible that we may need to speak briefly with **some** of the participating farmers. **Do we have your permission to contact you again?**

YES _____; **NO** _____

Following the completion of the study, we will be preparing a short summary of the results of this research. Would you like to receive a copy of this summary?

YES _____; **NO** _____

If you answered **YES** to either or both of the above, we need to know how to contact you. Please provide your name and telephone number in the space provided below:

_____

_____

Thank you for your cooperation in filling out this questionnaire. Your participation will enhance the quality of our final report and ensure that our findings reflect the attitudes and needs of the farmers who took part.